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BULLETIN OF THE

TAYLOR SOCIETY, new york

A SOCIETY TO PROMOTE THE SCIENCE AND THE
ART OF ADMINISTRATION AND OF MANAGEMENT

This number presents in detail some noteworthy illustrations of modern progressive management.

Engineering Societies Building
29 W. Thirty-Ninth St.
New York

FEBRUARY, 1923 VOL. VIII., NO. 1

TAYLOR SOCIETY

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AN INTERNATIONAL SOCIETY TO PROMOTE THE SCIENCE
AND THE ART OF ADMINISTRATION AND OF MANAGEMENT

Volume VIII
1923

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CONTENTS

I. TITLES

PAGE

Accounting—see general accounting as related to production control 241

Accounting—see labor classification and payroll analysis 69

Art of Management: from a British point of view—*Oliver Sheldon* 209

Bonus—see premium and bonus plans 59

Business Training for Military Officers—*Editorial* 208

Chapters from the Life of Frederick W. Taylor—*Frank Barkley Copley* 165

Chief Executive—see the ways and means of the chief executive 53

Comment, Editorial 1, 41, 81, 125, 161, 205

Communications—*Henry H. Farquhar, L. K. Frank* 38

Control of an Industry in the Business Cycle—*Howard Coonley* 128

Cycles, Business—see the control of an industry in the business cycle 128

Dr. Eliot on Standardization—*Editorial* 162

Editorial Comment 1, 41, 81, 125, 161, 205

Employment—see safeguarding industry by stabilizing employment 85

Excerpts 11, 30, 58, 65, 68, 95, 103, 119, 124, 149, 160, 177, 214, 236

Executive Control—see the planning department as an instrument of executive control . 104

Executive Control—see the ways and means of the chief executive 53

Expense, Classification of Payroll—see labor classification and payroll analysis 69

Field of Personnel Administration—*Ordway Tead* 237

Futility of Lockouts and Strikes—*Paul Ogilvie* 219

General Accounting as Related to Production Control—*Percy Stotenbur* 241

Industrial Relations—see the field of personnel administration 237

Industrial Relations—see two pioneer papers on industrial relations 225

Industrial Statesmanship—*Editorial* 206

International Society, An—*Editorial* 83

Labor Classification and Payroll Analysis—*Carleton F. Brown* 69
Abstracted Discussion.

Management Movement—*Richard H. Lansburgh* 46

Management Week, Committee on 201

Medium-sized Plant—see the organization and management of a medium-sized plant 12

Meetings, Programs and Reports of 43, 203, 245

Membership Campaign 203

Military Type of Organization—*W. Maxwell Reed* 141

1923 Model Sales Machine—*Harry R. Wellman* 96
Discussion by Willard E. Freeland and Creed W. Fulton.

No Safe Short Cut to High Production Management—*Henry H. Farquhar* 44

Office Management—see a practical plan for rating the efficiency of an office organization 178

PAGE

On the Contribution of Scientific Management to Industrial Problems—*H. S. Person* . . . 116

Organization—see the military type of organization . . . 141

Organization and Management of a Medium-sized Plant—*Percy S. Brown* . . . 12

Pay-roll Analysis—see labor classification and pay-roll analysis . . . 69

Personnel Administration—see the field of personnel administration . . . 237

Planning Department as an Instrument of Executive Control—*Keppele Hall* . . . 104
Discussion by Robert Julius Andersen, Howard G. Benedict and H. K. Hathaway.

Politics vs. Good Management in Public Business—*Editorial* . . . 127

Practical Plan for Rating the Efficiency of an Office Organization—*W. H. Leffingwell* . . . 178

Premium and Bonus Plans—*H. K. Hathaway* . . . 59

Present Status of Statistical Research in the Administration of Business—*C. L. Sweeting and D. K. Pfeffer* . . . 215

Production Control—see general accounting as related to production control . . . 241

Production and Selling, Coordination of—see the tie-up of sales and production . . . 137

Profit Sharing—*Frederick W. Taylor* . . . 164

Progressive Relation Between Efficiency and Consent—see two pioneer papers on industrial relations . . . 225

Purchasing Agent and Engineer—*W. E. Irish* . . . 150
Discussion by Claude T. Yates.

Reduction of Waste in Operating Departments of Large Retail Stores—*Philip J. Reilly* . . . 31
Discussion by W. H. Leffingwell.

Relieving Our Presidents—*Editorial* . . . 126

Retail Stores—see reduction of waste in operating departments of large retail stores . . . 31

Safeguarding Industry by Stabilizing Employment—*Wilfred I. King* . . . 85
Discussion by Carleton F. Brown and N. I. Stone.

Scientific Management and Organized Labor—see two pioneer papers on industrial relations . 225

Scientific Management—see the art of management: from a british point of view . . . 209

Scientific Management—see on the contribution of scientific management to industrial problems 116

Scientific Management—see unsystematized, systematized and scientific management . . . 189

Sections (of the Taylor Society), News of . . . 202, 246

Selecting Element Times—*O. A. Parmenter* . . . 120

Selling—see the 1923 model sales machine . . . 96

Selling and Production, Coordination of—see the tie-up of sales and production . . . 137

Stabilizing Employment—see safeguarding industry by stabilizing employment . . . 85

Standardization in Germany . . . 224

Statistical Compilation: some of its uses as a function of scientific management—*Harry B. Horwitz, Harry A. Wembridge and Herman J. Hutkin* . . . 3

Statistical Research—see the present status of statistical research in the administration of business . . . 215

Taylor—see chapters from the life of frederick w. taylor . . . 165

Taylor Society, Local Sections of . . . 202, 246

	PAGE
Taylor Society, Meetings of	43, 203, 245
Tie-up of Sales and Production—*L. J. Conger*	137
Time Study—*Dwight V. Merrick*	66
Time Study—see selecting element times	120
Two Pioneer Papers on Industrial Relations—*Robert G. Valentine*	225
Unemployment—see safeguarding industry by stabilizing employment	85
Unsystematized, Systematized and Scientific Management—*Henry P. Kendall*	189
Wage Payments—see premium and bonus plans	59
Washington News Letter—*Ray M. Hudson*	43, 83
Waste of Materials—*H. M. Sutton*	77
Waste, Reduction of—see reduction of waste in operating departments of large retail stores	31
Ways and Means of the Chief Executive—*John H. Williams*	53

II. AUTHORS

Andersen, Robert Julius—discussion of *The Planning Department as an Instrument of Executive Control*	111
Benedict, Howard G.—discussion of *The Planning Department as an Instrument of Executive Control*	114
Brown, Carleton F.—*Labor Classification and Payroll Analysis*	69
—discussion of *Safeguarding Industry by Stabilizing Employment*	89
Brown, Percy S.—*The Organization and Management of a Medium-Sized Plant*	12
Conger, L. J.—*The Tie-up of Sales and Production*	137
Coonley, Howard—*The Control of an Industry in the Business Cycle*	128
Copley, Frank Barkley—*Chapters from the Life of Frederick W. Taylor*	165
Farquhar, Henry H.—*No Safe Short Cut to High Production Management*	44
—*Communication*	38
Frank, L. K.—*Communication*	38
Freeland, Willard E.—discussion of *The 1923 Model Sales Machine*	100
Fulton, Creed W.—discussion of *The 1923 Model Sales Machine*	101
Hall, Keppele—*The Planning Department as an Instrument of Executive Control*	104
Hathaway, H. K.—*Premium and Bonus Plans*	59
—discussion of *The Planning Department as an Instrument of Executive Control*	115
Horwitz, Harry B. with harry a. wembridge and herman j. hutkin—*Statistical Compilation: Some of Its Uses as a Function of Scientific Management*	3
Hudson, Ray M.—*Washington News Letter*	43, 83
Hutkin, Herman J. with harry b. horwitz and harry a. wembridge—*Statistical Compilation: Some of Its Uses as a Function of Scientific Management*	3
Irish, W. E.—*Purchasing Agent and Engineer*	150
Kendall, Henry P.—*Unsystematized, Systematized and Scientific Management*	189
King, Wilfred I.—*Safeguarding Industry by Stabilizing Employment*	85

PAGE

Lansburgh, Richard H.—*The Management Movement* 46

Leffingwell, W. H.—*A Practical Plan for Rating the Efficiency of an Office Organization* 178

—discussion of *Reduction of Waste in Operating Departments of Large Retail Stores* 31

Merrick, Dwight V.—*Time Study* 66

Ogilvie, Paul—*The Futility of Lockouts and Strikes* 219

Parmenter, O. A.—*Selecting Element Times* 120

Person, H. S.—*On the Contribution of Scientific Management in Industrial Problems* 116

Pfeffer, D. K. with c. l. sweeting—*The Present Status of Statistical Research in the Administration of Business* 215

Reed, W. Maxwell—*The Military Type of Organization* 141

Reilly, Philip J.—*Reduction of Waste in Operating Departments of Large Retail Stores* 31

Sheldon, Oliver—*The Art of Management: From a British Point of View* 209

Stone, N. I.—discussion of *Safeguarding Industry by Stabilizing Employment* 89

Stotenbur, Percy—*General Accounting as Related to Production Control* 241

Sutton, H. M.—*Waste of Materials* 77

Sweeting, C. L. with d. k. pfeffer—*The Present Status of Statistical Research in the Administration of Business* 215

Taylor, Frederick W.—*Profit Sharing* 164

Tead, Ordway—*The Field of Personnel Administration* 237

Valentine, Robert G.—*Two Pioneer Papers on Industrial Relations* 225

Wellman, Harry R.—*The 1923 Model Sales Machine* 96

Wembridge, Harry A. with harry b. horwitz and herman j. hutkin—*Statistical Compilation: Some of Its Uses as a Function of Scientific Management* 3

Williams, John H.—*The Ways and Means of the Chief Executive* 53

Yates, Claude T.—discussion of *Purchasing Agent and Engineer* 157

III. REVIEWS

Applied Personnel Procedure, by *Frank E. Weakly*—reviewed by Louise C. Odencrantz . . . 248

Factory Storekeeping; the control and storage of materials, by *Henry H. Farquhar*—reviewed by D. J. Walsh, Jr. 39

Four-hour Day in Coal, by *Hugh Archbald*—reviewed by J. Shirley Eaton 40

Harvard Business Review—reviewed by Richard H. Lansburgh 80

How to Think in Business, by *Matthew Thompson McClure*—reviewed by H. S. Person 248

Mastering Power Production, by *Walter N. Polakov*—reviewed by Alfred Iddles 78

Practical Factory Administration, by *Matthew Porosky* 124

Trade Association Activities and the Law, by *Franklin D. Jones*—reviewed by Alfred L. Smith 39

Twelve Hour Shift in Industry, by *Committee on Work-Periods in Continuous Industry of the Federated American Engineering Societies*—reviewed by Robert W. Bruère 79

University Journal of Business—reviewed by Richard H. Lansburgh 80

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VOL. VIII FEBRUARY, 1923 No. 1

CONTENTS

COMMENT 1

STATISTICAL COMPILATION . . . 3
Some of Its Uses as a Function of Scientific Management.
By Harry B. Horwitz, Harry A. Wembridge and Herman J. Hutkin.

THE ORGANIZATION AND MANAGEMENT OF A MEDIUM-SIZED PLANT . 12
The Corona Typewriter Company, Ltd.
By Percy S. Brown.

REDUCTION OF WASTE IN OPERATING DEPARTMENTS OF LARGE RETAIL STORES 31
Work of the Retail Research Association.
By Philip J. Reilly.

COMMUNICATIONS 38

REVIEWS 39

COMMENT

IN every way—content, emphasis, illustrations, the reproduction of a Taylor cost distribution sheet—this issue of the BULLETIN is highly satisfactory. We do not recall that a Taylor cost distribution sheet has ever before been published. This reproduction will be of interest, not only to accountants and statisticians, but to factory managers as well. It is the product of statistical-accounting technique, but its purpose is information to executives for the purpose of *executive control of current operations*—not merely to tell the story of something in the past which is beyond control, which is characteristic of so many cost summaries. It should prove to be of unusual interest.

WHILE this cost distribution sheet is an example of a modern, carefully-devised cost technique, it is interesting to note that it does not differ in principle from such reports as devised by Taylor some thirty years ago. Few people know that he was one of that small group of pioneers in cost accounting. In so far as available evidence shows, he was the first to devise a system of cost accounting which tied in with the general accounts. In the files of the Taylor Society is a little document, deposited by Carl G. Barth, which is of historic interest; it is a prêprint of "A Piece-Rate System," "to be presented at the Detroit Meeting (June, 1895) of the American Society of Mechanical Engineers." On it is a rubber-stamp impression as follows:

FRED W. TAYLOR, M.E.,
Ross Street, Germantown, Philadelphia.
CONSULTING ENGINEER
Systematizing Shop Management and
Manufacturing Costs a Specialty.

In the early nineties, therefore, between the Midvale and Bethlehem periods, Taylor offered himself as a systematizer of shop management and a cost specialist. This professional period had three phases: first, primarily the systematizing of shop management, but experience soon showed him that such costs as the accountants of that day could furnish were of no use for purposes of control; second, there followed an intensive study of and emphasis on cost accounting which revolutionized (in his practice) the cost accounting of that day; third, realizing that shop efficiency was more important to his clients than improved cost accounting alone, a return to the emphasis on systematization of shop management with cost statistics subsidiary—a tool of factory management, a most important mechanism dependent upon and contributing to other mechanisms of good management.

IN those days cost accounting was something new—and an interest of shop executives rather than of accountants. A search of the leading bibliographies of management shows how little was then written on the subject. We can find only the following titles prior to 1900:

1885—Metcalf, Henry. The Cost of Manufactures and the Administration of Workshops, Public and Private. New York: J. Wiley & Sons.

1886—Metcalf, Henry. The Shop Order System of Accounts. In *Trans. A. S. M. E.*

1889—Anonymous. Engineering Estimates, Costs and Accounts. London.

1897—Channing, J. Parke. Mine Accounts. In *Engineering Magazine.*
—Roland, Henry. Cost-Keeping Methods in Machine Shop and Foundry. In *Engineering Magazine.*
—Russell, W. F. Foundry Costs. In *Government Accountant.*

1898—Norris, H. M. A Simple and Effective System of Shop Cost-Keeping. In *Engineering Magazine.*
—Roland, Henry. An Effective System of Finding and Keeping Shop Costs. In *Engineering Magazine.*

Taylor never wrote an article on cost accounting, although he worked out a precise and revolutionary system of cost accounting as a part of his general system of management. He came to consider the data for cost summaries as a by-product of his management routine, and the cost summaries themselves as a mechanism of that routine. He did not value highly cost data which did not flow currently and automatically out of operating routine, and which did not result in cost summaries which appeared promptly enough to influence current detail plans and control. It should be noted that he located cost accounting in the planning room, not in the accounting department.

BUT we set out to say something about the subject-matter of the Horwitz-Wembridge-Hutkin article, and have gone off at a tangent. That article is a clean-cut exposition of statistical control of operations in a plant employing some 1100 people. It shows what sort of statistical control has become possible for a plant of that size, at a moderate cost, as a result of the invention and perfection of sorting, tabulating and computing devices. One small unit can now do what formerly required a large, prohibitively expensive unit. It shows that statistical summaries can be "ground out" promptly enough to yield information in time to appraise current progress, and detect and correct operations which are not proceeding in accordance with plans. This particular paper does not discuss, but a reading between the lines shows, that back of the mechanical statistical operations must lie control of operating conditions, correct analysis of these conditions into all their elements, classification and valuation, and standards. Statistical control is not derived from the collection of casual data, but from the collection of data the nature of which has been determined in advance. Determination of the nature of those data requires precise and detail analysis of the conditions of operations, the establishment of operating standards and of a control which maintains those standards; and the data themselves must be capable of summarization in terms of these standards.

THE paper by Mr. Brown, describing the organization and the management methods of the Corona Typewriter Company, inspired an unusual amount of questioning and discussion at the November meeting. We imagine that the printed paper will be as stimulating to the reader. It is an over-all description of the organization and management of a medium-sized plant which makes a single assembled product, but also contributory to that makes for assembly stock some 450 different parts fabricated with precision, all together involving nearly 2500 operations. The manufacture of the parts and of the assembled product has been brought, to a remarkable degree, to the status of continuous-process manufacture. It is a point of view of the company that it has a moral obligation to give its people opportunity for continuous employment. There is involved, then, in the management of this plant the entire range of general and detail problems involved in good management: a calculated quantity of sales; policy and methods which produce that quantity of sales; schedules of production, over-all and by departments; research and establishment of standards; precise control through planning, scheduling and inspection; adequate but not superfluous inventories; every detail matching every other detail. There has been evolved a system of management which is model scientific management. It is a plant worth visiting.

WE are happy to be privileged to present a paper concerning the work of the Retail Research Association—pioneer in associated research in the field of retail store management. Since its modest beginning some ten years ago it has grown, under wise advisory and executive management, into a strong institution of great service to its members. It has been one of the forces to inspire outside its own membership inquiry into methods of management in retail distribution. There is no field of enterprise in which there are greater opportunities for betterment and economy of management, to the advantage of individual distributing concerns and of consumers. The spread between the fabricators' prices of commodities and the prices which the final consumers have to pay is one of the facts which is worrying consumers—and one on which consumers are focusing attention. The problem will be attacked through public agencies and through the establishment of public mechanisms of distributive management; but we are of the judgment that moral responsibility for and the understanding necessary for the solution resides in the distributors.

STATISTICAL COMPILATION: SOME OF ITS USES AS A FUNCTION OF SCIENTIFIC MANAGEMENT[1]

By Harry B. Horwitz, Harry A. Wembridge and Herman J. Hutkin[2]

IN former years, and not so very long ago at that, organizations of all kinds, in the manufacture of metals, in the production of chemical products, in the making of soaps, in fact in nearly every field of productive activity, were throwing into the waste heap vast quantities of materials which had apparently served their full purpose and were of no further use. Today many of these same waste materials are being used in the production of by-products, valuable to the community and profitable to the producer. This utilization of what was formerly a complete waste has of course resulted in lessened cost of manufacture, increased profit and frequently has meant the difference between failure and success.

This paper proposes to deal with another class of materials which are necessary to produce certain essential products, but which, after performing their primary function, are all too frequently thrown into the waste heap, when by the use of proper methods they could be turned into valuable and profitable by-products.

The materials to which I refer are figures. It can hardly be disputed that any present-day manufacturing and selling organization, any one, that is, that makes any pretense whatever to the use of modern methods, must have at its disposal certain figures without which it cannot function. Certainly it has a payroll. Equally certainly it has orders from its customers, factory orders to put its products into work, a record of the materials and supplies withdrawn from stores and put into process, a record of the performance of the factory or production organization in turning out the product. In all probability it has on file details of the individual employees, such as their age, sex, residence, former employment, and other such information as is ordinarily furnished by the applicant for a job.

These figures, as I have stated, are available to all of us; but the question is: Do we make the best possible use of them? In using them for their original purpose, do we turn out the best possible product? And when they have fulfilled that purpose, do we convert them into valuable and profitable by-products, or do we throw them into the waste heap, bury them in the files and never refer to them again?

In our organization we have had the experience, which I have no doubt is common to all concerns, of irregular but frequent requests, by administrative and higher executive officials or by outside agencies, for information involving a special and laborious search through the files. The objectionable features of such procedure are many. First is the embarrassment to the division called upon to furnish this information, caused by diverting the activities of one or more of its clerks from their regular jobs. Next is the obvious duplication of effort involved. For example, today we have to furnish the information for a questionnaire from the Department of Labor and two clerks are assigned to dig out the data. Tomorrow or next week we have a request by one of the managers for a special report. Had we only known it at the time we could have obtained the information necessary for this report at the same time that we secured the data for the questionnaire, and with little or no additional effort. Now we again have to take the clerks away from their jobs for a number of hours and set them at digging into the files once more. Furthermore, the information is frequently inaccurate, as it is obtained in a hurry and usually by persons not especially adapted to the work.

In order to eliminate these objectionable features, and at the same time to make the desired information more readily available, we have organized what we call our statistical division, in which we have included all functions formerly engaged in furnishing regular or special statistical information. This division acts as a clearing house through which pass all the figures referred to above; payrolls, stores issues, work started,

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[1] A paper presented at a meeting of the Taylor Society, New York, Nov. 23, 1922.

[2] Of the Planning Department, the Statistical Division and the Methods Division, respectively, of The Joseph & Feiss Company, Cleveland.

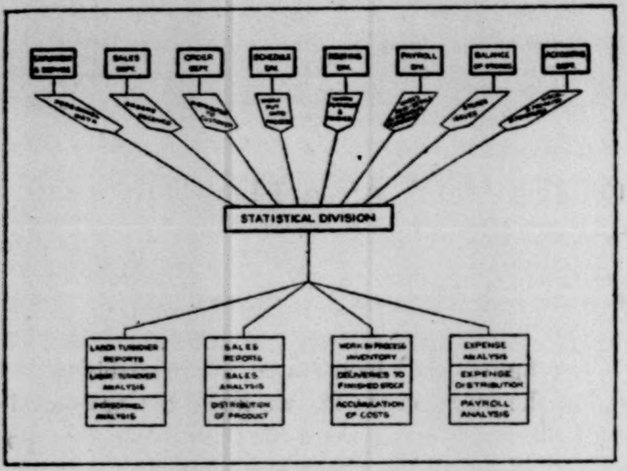


Fig. 1. Flow of Data into and of Reports out of the Statistical Division.

work finished, orders, shipments, etc. Under a specially qualified executive and with a specially trained personnel, it can turn out its main products—sales reports, material reports, expense reports, cost reports, etc.—more regularly, more frequently and more accurately than we could obtain them in any other way. And the material used in the production of those main products is sorted and classified in such a way as to make it available for the production of by-products—periodic and special reports of all kinds, regular and special analysis of orders, of expenditures, of processes, many of which would be otherwise out of the question because of the prohibitive expense, both in time and money, involved in getting out the data as an independent undertaking.

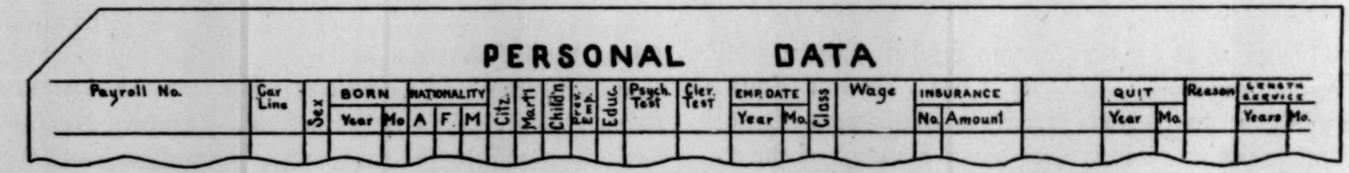


Fig. 2. Sketch of Top of Hollerith Personal Data Card.

It is not proposed in this paper to put forth any argument as to the necessity for any of these reports or as to the merits of any particular form of presenting them. All this paper will attempt to show is that they can and should be obtained in the ordinary course of well-conducted scientific management and that their compilation and presentation is a distinct function of such management. It would be impossible to attempt to go into detail concerning all phases of the work of this division. The object of this paper is to give a brief summary of its principal activities, display a few slides to show some of the results, and conclude with a somewhat more complete exposition of one of the chief products of the division which I believe will be of interest to all of you —the expense distribution sheet and the steps necessary to obtain it, together with some of the incidental results or by-products that we obtain while getting it.

Figure 1 gives a general view of the flow of figures into the statistical division and of the nature of the reports, both periodical and occasional, that flow out of it.

From the Employment and Service Department comes all information concerning new employees, and changes in the status of old employees. This information is transferred to punched cards (Figure 2), one for each employee, and these cards are sorted and filed in numerical order. When any employee leaves or is discharged, the date of quitting and the reason (furnished also by the Employment and Service Department) are punched on the card, and the card is transferred to a file of "quitters." These cards contain, in addition to the name, which is printed on the back, columns for employee's payroll number, car line used, sex, year and month of birth, nationality of applicant and of his parents, status of citizenship (citizen, alien, etc.), marital condition, number of children, previous employment, education, standing in psychological and clerical tests, date of employment, class of employment (whether piece work, hour work or week work) wage rate, insurance record, date of leaving and length of service. After the files are once established the labor of maintaining them is practically negligible, and the information to be obtained from them by mechanical sorting and tabulation is almost without limit. Labor turnover records, of course, are the first product of this phase of the division's work, but, by means of the data on the punched cards the turnover can be dissected and analyzed and becomes the source of very valuable information. Similar analyses are made from the cards of the employed personnel, and these analyses are of tremendous assistance to the Employment Division in determining what applicants to accept, or rather, what applicants to reject. The expense of instructing new employees is a very considerable item in most plants where a certain amount of skill must be attained, and a great part of this expense can be saved if we can intelligently eliminate those applicants whose qualifications would indicate a probable short duration of employment. For instance, if the records show that out of twenty-five new employees, single, alien, of foreign parentage, and with only common-school education, only one remained after three months, it would seem the part of wisdom to reject the next employee having those same qualifications. Such rejections are as much to the advantage of the employee as to that of the employer.

Detailed reports of this kind should be furnished periodically. Other reports can be had when desired. This service is especially useful in filling out the numerous questionnaires requested by labor bureaus and the various other agencies that are always asking for information. These are usually a source of great annoyance, consume considerable time, and are frequently filled out without too much regard for accuracy. By means of the cards referred to above this work can be done quickly, accurately, and without interfering with the routine of any department.

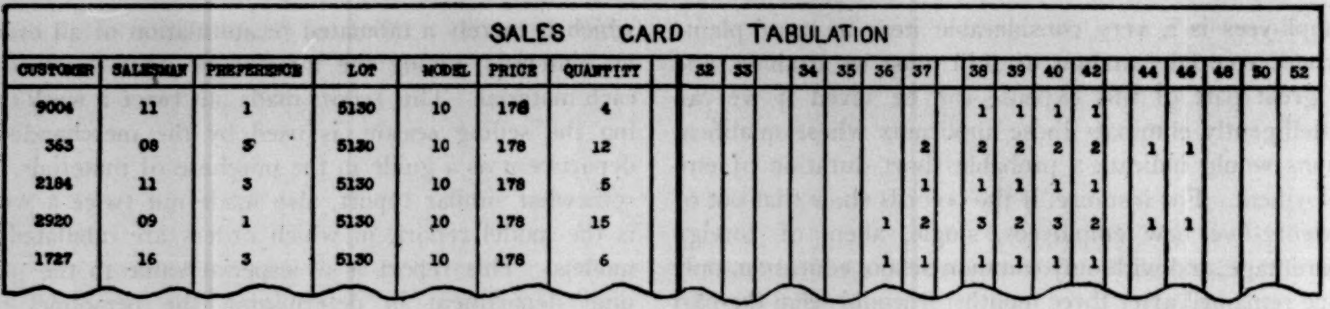
The special uses for this personnel data are innumerable. Take as an example the column in which is punched, in code of course, the car line used. In case of a breakdown in the service on any car line, we are able to determine, at a moment's notice, the number and names of all employees who will be delayed or prevented from reporting for work. In case of a street car strike, where it is necessary to provide motor transportation, it is easy to determine just how many persons to provide for in each section of the city.

Now let us look at the Statistical Division's work in connection with the receiving and handling of orders. When any order is received and approved it is delivered immediately to the statistical division where all data are transferred to another set of punched cards. These cards form the basis of over twenty-five different reports, some seasonal, weekly or even daily, some only occasional, and others only when requested by the department or official requiring the information. For an experienced punch operator, much less time is needed to punch the card than would be required to post the information on a card or ledger sheet, and, once the cards are punched, it is a mere matter of mechanical sorting and tabulating to obtain any of the many reports needed.

One of the more important periodical reports furnished from the above data is the lot or material report, which is merely a tabulated recapitulation of all orders by materials, giving the number of items ordered in each material. This report made out twice a week during the selling season, is used by the merchandising department as a guide in the purchase of materials. A somewhat similar report, also made out twice a week, is the model report, in which orders are tabulated by models. This report is of especial value to the planning department in determining the personnel and equipment required to manufacture the various kinds of product in the proportion in which they have been ordered. Both of these reports are used by the sales department as a record of the season's result to date, as a basis of estimating the probable totals, and as a guide in issuing directions to its salesmen—withdrawing certain materials when the supply is exhausted, or directing the pushing of certain models or materials when in the judgment of the department such action seems advisable.

The next step in the use of these data (and please bear in mind that these are still the same cards punched upon the original receipt of the order) is to furnish information on which to base the starting of work in process. At this point it might be well to explain that our product is a seasonal one, and that with the exception of certain staple materials it is impossible to have on hand in advance any great part of a season's requirements. It is frequently necessary to put material into work almost immediately after receipt. In order to manufacture most economically we do not use this material to fill any specific customers' orders but rather to complete our schedule in certain models. This being the case, as soon as material is received, or at any other time when material is to be put into work, it is essential to know at once, the number of items ordered in this material, the number of items in each model in which the material is used, and the number of items in each size in each model.

For the coming season we are handling over 500 materials in over sixty models, and each model is made in a large range of sizes, so that to maintain a ledger by materials and models involves the possibility of more than 30,000 ledger sheets, each of which is provided with at least sixteen columns for sizes. When hundreds of orders are being received each week it can readily be seen that the labor of posting to such a ledger from individual orders, either by hand or machine, would be stupendous. By means of our punched cards, this laborious process is very greatly simplified. The cards representing all orders received since the pre-



SALES CARD TABULATION

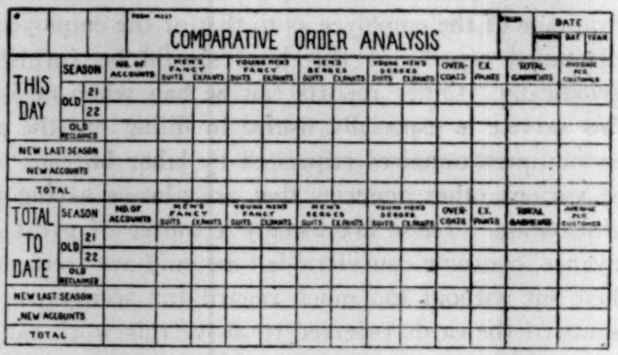
CUSTOMER	SALESMAN	PREFERENCE	LOT	MODEL	PRICE	QUANTITY		32	33		34	35	36	37		38	39	40	42		44	46	48	50	52
9004	11	1	5130	10	178	4										1	1	1	1						
363	08	5	5130	10	178	12								2		2	2	2	2		1	1			
2184	11	3	5130	10	178	5								1		1	1	1	1						
2920	09	1	5130	10	178	15							1	2		3	2	3	2		1	1			
1727	16	3	5130	10	178	6							1	1		1	1	1	1						

Fig. 3. Ledger Posting Report—Sales.

vious report are sorted by material, by model and by customer, and then tabulated on what is known as a Ledger Posting Report, of which Figure 3 is a sample. This report is presented twice each week during the selling season and serves many purposes. First it serves as a check against errors both in the original orders and in transcribing them to the cards. Next it forms a basis for records of individual salesmen. And finally the totals at the end of each model are used as the medium for posting to the ledger record of items sold in the various materials, models and sizes. Were it not for this system we should have to make a separate posting for each of the items shown in the body of the report, instead of which we need post only the items shown in the line of totals. Furthermore, these items are arranged in numerical order and in the same order in which the ledger sheets are arranged, thus eliminating the necessity of hunting through the ledger to find the right page on which to make the entry. When we consider that this process must be repeated for 500 materials in sixty model variations, the saving in time and labor becomes most impressive.

Now let us assume that a quantity of items in any material and model have been put into work. The question then arises: To what customers should these items be delivered? Again we go back to our cards, and the answer to the question is simple. We merely select the cards for the material and model in question, sort them by customers and we have a tabulated report giving all the information necessary for distribution.

These are not the only products of these detailed punched cards but they are the principal ones. What I wish to emphasize is not the value of the reports themselves, but the simplicity, speed and accuracy of obtaining them. On a recent occasion we timed a punch operator and found that in less than half a day he transferred to cards the data from 120 orders for over 11,000 items of merchandise; immediately thereafter these cards were sorted in with cards for previous totals, and tabulated for the ledger posting report. The entire job, including the punching of the cards, sorting and tabulating for two large reports required less than seven hours' time of two men. And most important of all, the reports were absolutely up-to-date, including all orders that had been delivered by mail four hours before.



COMPARATIVE ORDER ANALYSIS

DATE

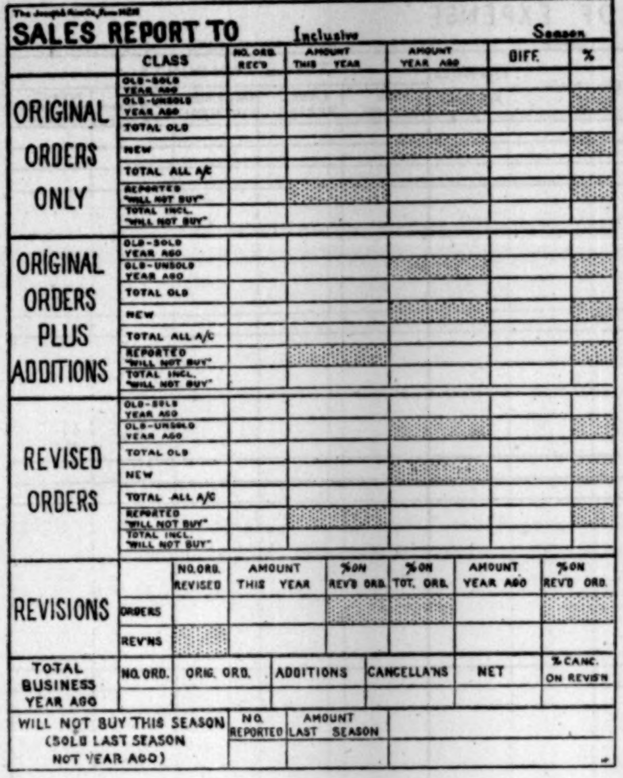
DAY YEAR

			NO. OF ACCOUNTS	MEN'S FANCY SUITS	MEN'S FANCY EX. PANTS	YOUNG MEN'S FANCY SUITS	YOUNG MEN'S FANCY EX. PANTS	MEN'S SERGES SUITS	MEN'S SERGES EX. PANTS	YOUNG MEN'S SERGES SUITS	YOUNG MEN'S SERGES EX. PANTS	OVER-COATS	EX. PANTS	TOTAL GARMENTS	AVERAGE PER CUSTOMER
THIS DAY	SEASON														
	OLD	21													
		22													
	OLD RECLAIMED														
NEW LAST SEASON															
NEW ACCOUNTS															
TOTAL															
TOTAL TO DATE	SEASON		NO. OF ACCOUNTS	MEN'S FANCY SUITS	MEN'S FANCY EX. PANTS	YOUNG MEN'S FANCY SUITS	YOUNG MEN'S FANCY EX. PANTS	MEN'S SERGES SUITS	MEN'S SERGES EX. PANTS	YOUNG MEN'S SERGES SUITS	YOUNG MEN'S SERGES EX. PANTS	OVER-COATS	EX. PANTS	TOTAL GARMENTS	AVERAGE PER CUSTOMER
	OLD	21													
		22													
	OLD RECLAIMED														
NEW LAST SEASON															
NEW ACCOUNTS															
TOTAL															

Fig. 4. Comparative Order Analysis.

Let us now turn to a somewhat different, but closely allied, group of reports—those used for purposes of comparison. For this group we punch a different set of cards, also however from the original order. On these cards we omit details of materials, models and sizes, but include amounts in money, and classify the orders by classes of product and of material, by district, size of town, by type of customer and by salesman.

From these cards we obtain a number of extremely interesting and valuable reports. For instance, let us look at the Comparative Order Analysis (Figure 4). This report is divided into two parts, the upper for the day for which the report is submitted, and the lower for the season to date. The first two horizontal headings refer only to orders from all customers who placed an order the corresponding season of the previous year. The items ordered are divided into ten subdivisions, thus allowing comparison and analysis of the orders by



SALES REPORT TO Inclusive Season

	CLASS	NO. ORD. REC'D	AMOUNT THIS YEAR	AMOUNT YEAR AGO	DIFF.	%
ORIGINAL ORDERS ONLY	OLD-SOLD YEAR AGO					
	OLD-UNSOLD YEAR AGO			▨		▨
	TOTAL OLD					
	NEW			▨		▨
	TOTAL ALL A/C					
	REPORTED "WILL NOT BUY"		▨			▨
	TOTAL INCL. "WILL NOT BUY"					
ORIGINAL ORDERS PLUS ADDITIONS	OLD-SOLD YEAR AGO					
	OLD-UNSOLD YEAR AGO			▨		▨
	TOTAL OLD					
	NEW			▨		▨
	TOTAL ALL A/C					
	REPORTED "WILL NOT BUY"		▨			▨
	TOTAL INCL. "WILL NOT BUY"					
REVISED ORDERS	OLD-SOLD YEAR AGO					
	OLD-UNSOLD YEAR AGO			▨		▨
	TOTAL OLD					
	NEW			▨		▨
	TOTAL ALL A/C					
	REPORTED "WILL NOT BUY"		▨			▨
	TOTAL INCL. "WILL NOT BUY"					

REVISIONS		NO. ORD. REVISED	AMOUNT THIS YEAR	% ON REV'D ORD.	% ON TOT. ORD.	AMOUNT YEAR AGO	% ON REV'D ORD.
	ORDERS			▨	▨		▨
	REV'NS	▨					

TOTAL BUSINESS YEAR AGO	NO. ORD.	ORIG. ORD.	ADDITIONS	CANCELLA'NS	NET	% CANC. ON REVIS'N

WILL NOT BUY THIS SEASON (SOLD LAST SEASON NOT YEAR AGO)	NO. REPORTED	AMOUNT LAST SEASON	

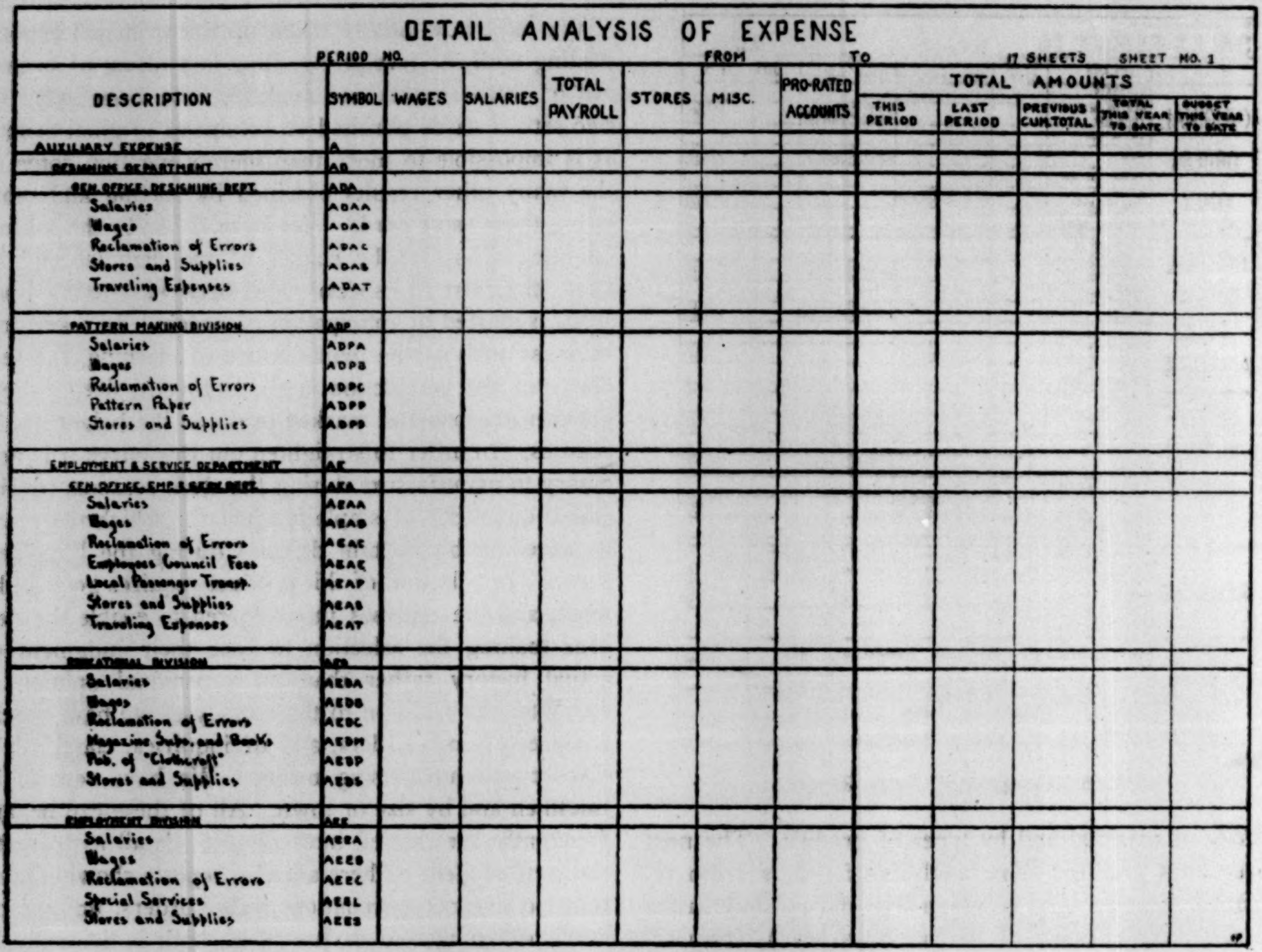
Fig. 5. Comparative Sales Report.

classes of material and by types of product. The next three lines give the same analysis of orders from reclaimed accounts (old accounts who did not buy in the corresponding season of the previous year), from accounts which are only one season old, and from accounts new the present season. The last line gives the totals for all accounts, new or old. The last column, showing average number of items per order, is a convenient method of comparison between various seasons and between various kinds of customers. The lower half of the report is, of course, a duplicate of the upper part, but the figures are cumulative for the season. These figures, as well as those on other forms shown, are quite evidently fictitious.

A somewhat similar report is shown as the Comparative Sales Report (Figure 5). This is a comparison, expressed in dollars and in percentage of increase or decrease between the volume of business booked during the current season and the sales to the same customers during the corresponding season one year before. It also shows the purchase of all customers who did not buy the previous year. As the season progresses the report also shows the volume and percentage of additions to original orders as well as cancellations and revisions.

We have now briefly taken up the principal reports dealing with the receipt, handling and filling of orders. All of these reports and analyses have been based on two sets of cards punched on receipt of original orders. It is impossible to more than merely mention some of the many other results obtained by sorting and tabulating these same cards. We have, just for the asking, analyses of orders by classes of merchandise and by sizes; these are of especial value between seasons when work is started in anticipation of orders. In a seasonal business such as the manufacture of clothing, the tendency of the production curve is toward deep valleys between seasons and marked peaks in the height of the seasons. In order to straighten out this curve it is necessary to manufacture during the slack seasons, considerable quantities of staple product for which there will be a reasonably certain demand during the busy seasons. The selection of this product requires good judgment, and the analyses just referred to enable the persons making the selection to base their judgment on actual history rather than on a personal opinion or estimate. In addition to these analyses we have special analyses of mail orders, and of inquiries, classified by district and advertising media. We have reports by salesmen and by size or town. All of these can be, and frequently are carried into complete detail as to materials and models. There are also reports showing additions to orders, cancellations, filled orders, unfilled orders, percentages of orders filled, both individually by customers and as a whole. And there are others, too numerous to mention. Most of them are furnished at regular intervals during certain parts of each season, but any one can be furnished as often as needed.

The next phase of the Statistical Division's work is in connection with work in process. All cutting or manufacturing orders issued by the Scheduling Division of the Planning Department are divided for convenience of manufacture into a number of smaller units, called batches, of from one to twenty items each, and a sub-manufacturing order issued for each batch. Copies of all manufacturing orders and sub-manufacturing orders are delivered to the Statistical Division. The main manufacturing order acts as a detailed job cost collecting medium. From the sub-manufacturing cards are punched cards containing details of the items put into work and identifying them with the manufacturing order. These cards form an active inventory of all work in process, and by mechanically sorting and tabulating them, we have at very short notice full details as to the number, kinds, and sizes of all items of work.



DETAIL ANALYSIS OF EXPENSE

PERIOD NO. FROM TO 17 SHEETS SHEET NO. 1

DESCRIPTION	SYMBOL	WAGES	SALARIES	TOTAL PAYROLL	STORES	MISC.	PRO-RATED ACCOUNTS	TOTAL AMOUNTS				
								THIS PERIOD	LAST PERIOD	PREVIOUS CUM. TOTAL	TOTAL THIS YEAR TO DATE	BUDGET THIS YEAR TO DATE
AUXILIARY EXPENSE	A											
DESIGNING DEPARTMENT	AD											
GEN. OFFICE, DESIGNING DEPT.	ADA											
Salaries	ADAA											
Wages	ADAB											
Reclamation of Errors	ADAC											
Stores and Supplies	ADAS											
Traveling Expenses	ADAT											
PATTERN MAKING DIVISION	ADP											
Salaries	ADPA											
Wages	ADPB											
Reclamation of Errors	ADPC											
Pattern Paper	ADPP											
Stores and Supplies	ADPS											
EMPLOYMENT & SERVICE DEPARTMENT	AE											
GEN. OFFICE, EMP. & SERV. DEPT.	AEA											
Salaries	AEAA											
Wages	AEAB											
Reclamation of Errors	AEAC											
Employees Council Fees	AEAC											
Local Passenger Transp.	AEAP											
Stores and Supplies	AEAS											
Traveling Expenses	AEAT											
EDUCATIONAL DIVISION	AED											
Salaries	AEDA											
Wages	AEDB											
Reclamation of Errors	AEDC											
Magazine Subs. and Books	AEDM											
Pub. of "Clothcraft"	AEDP											
Stores and Supplies	AEDS											
EMPLOYMENT DIVISION	AEE											
Salaries	AEEA											
Wages	AEEB											
Reclamation of Errors	AEEC											
Special Services	AEEL											
Stores and Supplies	AEES											

Fig. 6. First Page of Detailed Expense Analysis.

The Routing Division furnishes the Statistical Division with a report of all batches finished. Cards for these batches are then removed from the file of work in process and are sorted and tabulated each day to show the total deliveries to finished stock, in each material and model by sizes. The cards so removed are held until the end of the period, then sorted and tabulated for use in connection with the expense distribution sheet to which reference will be made later.

Let us now turn to the more strictly financial end of the Statistical Division's activities, the collection and distribution of expenditures, and incidentally though no less important, the analysis of the pay roll. For this purpose our expenditures are divided into three main groups: the product group, embracing all direct labor and material going into the product to be sold; the construction group, including direct labor and material used in addition or improvements to equipment, buildings and grounds; and finally the expense group, involving all expenses, which eventually will be distributed over one or the other of the first two groups. In order to make dependable financial reports there is requisite a complete and well-defined classification of accounts, so that each individual expenditure will automatically fall into its proper place on the classification. We are using the Taylor mnemonic system of classification, in which expenses are grouped under five main headings from A to E, the product (including stores) under F to W, and the construction group under X to Z.

Dealing first with the expense group: Under the above method of classification we are able to list all accounts, alphabetically according to symbol, on what we term a Detailed Expense Analysis, the first page of which is illustrated by Figure 6. On this sheet we show for each account the total of its expenditures for the

The Joseph & Feiss Company
METHODS DIVISION
PLATE No. MP 101
DEVISED AUGUST, 1922

EXPENSE

SECTION ONE	DIRECT MAKING WAGES {OBTAINED FROM DIVISIONAL PAYROLL DISTRIBUTION SUMMARY IN STATISTICAL DIVISION
	DIRECT CUTTING WAGES {OBTAINED FROM PAYROLL RECAPITULATION
	INDIRECT WAGES {OBTAINED FROM PAYROLL RECAPITULATION
	SALARIES {OBTAINED FROM PAYROLL RECAPITULATION
	TOTALS OF WAGES AND SALARIES OF ALL COLUMNS
	STORES USED DURING THIS PERIOD {OBTAINED FROM STORES ISSUES
	MISCELLANEOUS EXPENSES {OBTAINED FROM MISCELLANEOUS DETAIL SHEETS IN REGISTER OF ACCOUNTS PAYABLE
	PRO-RATED ACCOUNTS {OBTAINED FROM THE GENERAL JOURNAL
SECTION TWO	TOTALS OF ALL COLUMNS
	DISTRIBUTE SMALL TRIMMINGS EXPENSE {[illegible]
	PRO-RATED SELLING EXPENSE {[illegible]
	ADD EXPENSE FOR CONSTRUCTION AND SPECIAL ORDER GARMENTS {[illegible]
	DEDUCT FROM "B", "A", AND "C" THE AMOUNT OF EACH ADDED TO CONSTRUCTION AND SPECIAL ORDER GARMENTS {[illegible]
	BALANCE OF BUSINESS, AUXILIARY, AND SELLING EXPENSE {[illegible]
	TOTAL COST OF NEW EQUIPMENT, BUILDINGS & GROUNDS, AND SPECIAL ORDER GARMENTS
	DISTRIBUTE BUSINESS EXPENSE {[illegible]
	DISTRIBUTE AUXILIARY EXPENSE {[illegible]
	TOTAL GENERAL SHOP EXPENSE
	DISTRIBUTE GENERAL SHOP EXPENSE {[illegible]
	TOTAL SPONGING DIVISION, CUTTING DIVISION, AND MAKING DIVISION EXPENSE
	DISTRIBUTE SPONGING DIVISION EXPENSE {[illegible]
	DISTRIBUTE CUTTING DIVISION EXPENSE {[illegible]
	TOTAL CUT & TRIM COST OF EXTRA TROUSERS, SUITS, AND OVERCOATS
	DISTRIBUTE MAKING DIVISION EXPENSE {[illegible]
	TOTAL MAKING COST OF EXTRA TROUSERS, SUITS, AND OVERCOATS
	ADD CUT & TRIM COST AND MAKING COST OF EXTRA TROUSERS, SUITS, AND OVERCOATS {[illegible]
	TOTAL MANUFACTURING COST OF EXTRA TROUSERS, SUITS, AND OVERCOATS
SECTION THREE	SMALL TRIMMINGS EXPENSE RATE {[illegible]
	SMALL TRIMMINGS EXPENSE DETAIL RATES {[illegible]
	BUSINESS EXPENSE RATE {[illegible]
	GENERAL SHOP EXPENSE RATE {[illegible]
	SPONGING DIVISION EXPENSE RATE {[illegible]
	SPONGING DIVISION EXPENSE DETAIL RATES {[illegible]
	CUTTING DIVISION EXPENSE RATE {[illegible]
	MAKING DIVISION EXPENSE RATE {[illegible]
SECTION FOUR	MANUFACTURING COST OF EXTRA TROUSERS, SUITS, AND OVERCOATS FINISHED THIS PERIOD {[illegible]
	DISTRIBUTE PRO-RATED SELLING EXPENSE {[illegible]
	TOTAL SELLING COST OF EXTRA TROUSERS, SUITS, AND OVERCOATS
SECTION FIVE	PRO-RATED SELLING EXPENSE RATE {[illegible]
SECTION SIX	TOTAL POSSIBLE HOURS {[illegible]
	IDLE TIME "B", "A", "DA", AND PRO-RATED "C" EXPENSE RATES {[illegible]
	IDLE TIME "DS" "DC", AND "DM" EXPENSE RATES {[illegible]
	ADJUSTMENT OF EXPENSE FOR IDLE TIME {[illegible]

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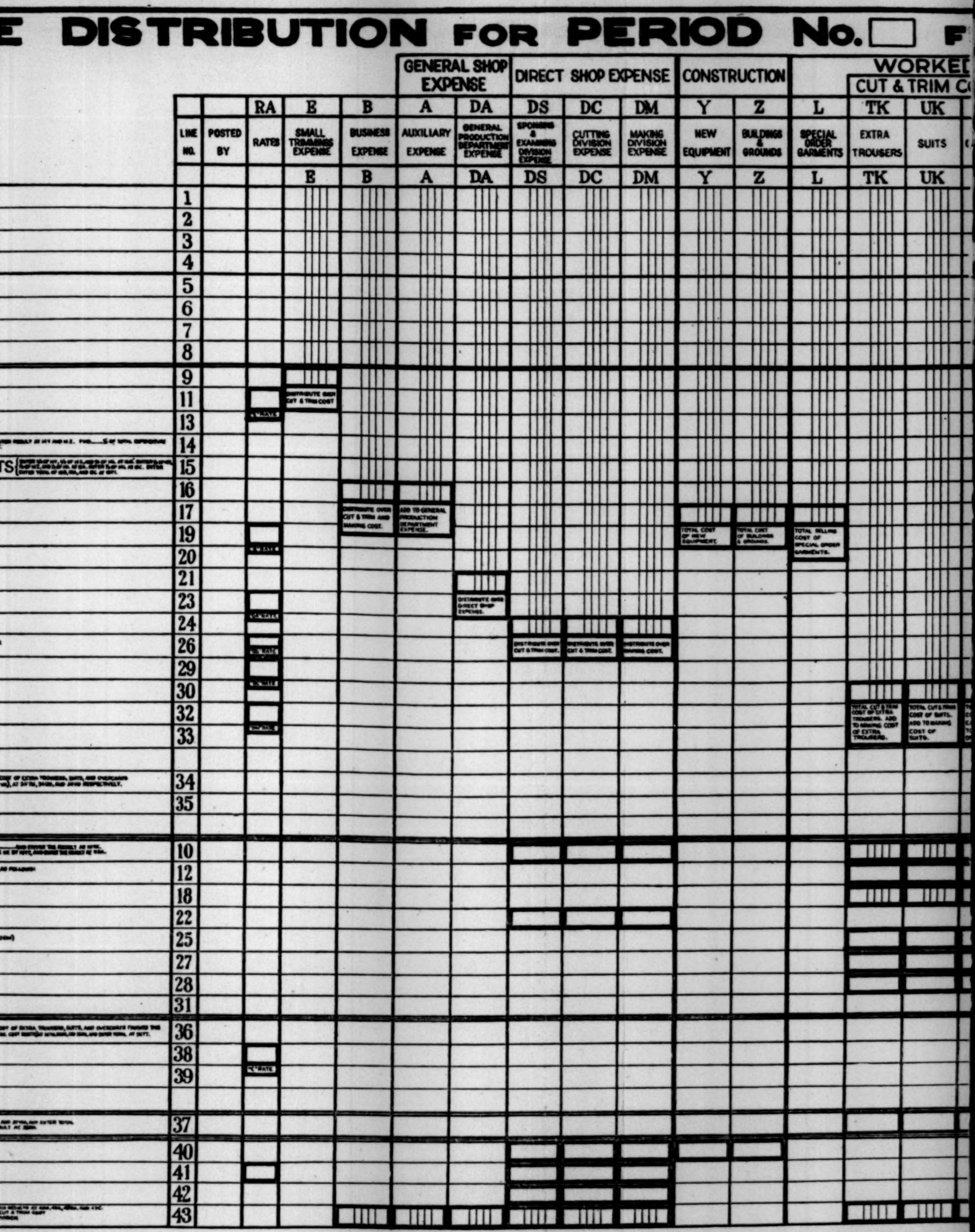

E DISTRIBUTION FOR PERIOD No. ☐ F

				GENERAL SHOP EXPENSE		DIRECT SHOP EXPENSE			CONSTRUCTION			WORKE	
												CUT & TRIM C	
		RA	E	B	A	DA	DS	DC	DM	Y	Z	L	TK	UK
LINE NO.	POSTED BY	RATES	SMALL TRIMMINGS EXPENSE	BUSINESS EXPENSE	AUXILIARY EXPENSE	GENERAL PRODUCTION DEPARTMENT EXPENSE	SPONGING & EXAMINING DIVISION EXPENSE	CUTTING DIVISION EXPENSE	MAKING DIVISION EXPENSE	NEW EQUIPMENT	BUILDINGS & GROUNDS	SPECIAL ORDER GARMENTS	EXTRA TROUSERS	SUITS
			E	B	A	DA	DS	DC	DM	Y	Z	L	TK	UK
1														
2														
3														
4														
5														
6														
7														
8														
9														
11			DISTRIBUTE OVER CUT & TRIM COST											
13														
14														
15														
16														
17				DISTRIBUTE OVER CUT & TRIM AND MAKING COST.	ADD TO GENERAL PRODUCTION DEPARTMENT EXPENSE.									
19										TOTAL COST OF NEW EQUIPMENT.	TOTAL COST OF BUILDINGS & GROUNDS.	TOTAL SELLING COST OF SPECIAL ORDER GARMENTS.		
20														
21														
23						DISTRIBUTE OVER DIRECT SHOP EXPENSE.								
24														
26							DISTRIBUTE OVER CUT & TRIM COST.	DISTRIBUTE OVER CUT & TRIM COST.	DISTRIBUTE OVER MAKING COST.					
29														
30														
32													TOTAL CUT & TRIM COST OF EXTRA TROUSERS. ADD TO MAKING COST OF EXTRA TROUSERS.	TOTAL CUT & TRIM COST OF SUITS. ADD TO MAKING COST OF SUITS.
33														
34														
35														
10														
12														
18														
22														
25														
27														
28														
31														
36														
38														
39														
37														
40														
41														
42														
43														

Fig. 7. Taylor Periodic Expense Distribution Sheet.

ERIOD No. ☐ FROM ☐☐☐ TO ☐☐☐

PENSE	CONSTRUCTION			WORKED MATERIALS						STORES SOLD				
				CUT & TRIM COST			MAKING COST							
DM	Y	Z	L	TK	UK	VK	TM	UM	VM	S	C		TT	
MAKING DIVISION EXPENSE	NEW EQUIPMENT	BUILDINGS & GROUNDS	SPECIAL ORDER GARMENTS	EXTRA TROUSERS	SUITS	OVERCOATS	EXTRA TROUSERS	SUITS	OVERCOATS	STORES ISSUED FOR SALE	SELLING EXPENSE	LINE NO.	TOTALS OF ENTRIES ON HORIZONTAL LINES	
DM	Y	Z	L	TK	UK	VK	TM	UM	VM	SS	C			
												1		TOTAL DIRECT MAKING WAGES
												2		TOTAL DIRECT CUT & TRIM WAGES
												3		TOTAL INDIRECT WAGES
												4		TOTAL SALARIES
												5		TOTAL PAYROLL
												6		TOTAL COST OF STORES USED
												7		TOTAL MISCELLANEOUS EXPENSES
												8		TOTAL PRO-RATED EXPENSES
												9		TOTAL OF ALL EXPENSES FOR THIS PERIOD
										TOTAL COST OF STORES SOLD FROM STOREROOM OR BILLED BY BILLING DIVISION	CREDIT TO RESERVE FOR SELLING EXPENSE	11		TOTAL AMOUNT OF SMALL TRIMMINGS EXPENSE DISTRIBUTED
												13		
												14		TOTAL AMT. OF EXPENSE ADDED TO CONSTRUCTION AND SPEC. ORD. GARMENTS
												15		TOTAL AMT. DEDUCTED FROM "B", "A", AND "C" FOR CONSTRUCTION AND SPEC. ORD. GARMENTS
												16		
											DISTRIBUTE OVER WORKED MATERIALS FINISHED THIS PERIOD.	17		
	TOTAL COST OF NEW EQUIPMENT	TOTAL COST OF BUILDINGS & GROUNDS	TOTAL SELLING COST OF SPECIAL ORDER GARMENTS.									19		TOTAL AMOUNT OF BUSINESS EXPENSE DISTRIBUTED
												20		
												21		
												23		TOTAL AMOUNT OF GENERAL SHOP EXPENSE DISTRIBUTED
												24		
STRIBUTE OVER AKING COST.												26		TOTAL AMOUNT OF SPONGING DIVISION EXPENSE DISTRIBUTED.
												29		TOTAL AMOUNT OF CUTTING DIVISION EXPENSE DISTRIBUTED
												30		TOTAL CUT & TRIM COST OF WORKED MATERIALS IN PROCESS
				TOTAL CUT & TRIM COST OF EXTRA TROUSERS. ADD TO MAKING COST OF EXTRA TROUSERS.	TOTAL CUT & TRIM COST OF SUITS. ADD TO MAKING COST OF SUITS.	TOTAL CUT & TRIM COST OF OVERCOATS. ADD TO MAKING COST OF OVERCOATS.						32		TOTAL AMOUNT OF MAKING DIVISION EXPENSE DISTRIBUTED
												33		TOTAL MAKING COST OF WORKED MATERIALS IN PROCESS
							TOTAL MAKING COST OF EXTRA TROUSERS	TOTAL MAKING COST OF SUITS.	TOTAL MAKING COST OF OVERCOATS.					
												34		
												35		TOTAL MANUFACTURING COST OF WORKED MATERIALS IN PROCESS
							TOTAL MFG. COST OF EXTRA TROUSERS.	TOTAL MANUFACTURING COST OF SUITS.	TOTAL MANUFACTURING COST OF OVERCOATS.					
												10		TOTAL AMOUNT OF THEORETICAL SMALL TRIMMINGS EXPENSE
												12		
												18		TOTAL AMOUNT OF WAGES AND SALARIES FOR DISTRIBUTION OF BUSINESS EXPENSE
												22		TOTAL HOURS FOR DISTRIBUTION OF GENERAL SHOP EXPENSE
												25		TOTAL YARDAGE FOR DISTRIBUTION OF SPONGING DIVISION EXPENSE
												27		
												28		TOTAL MARKING AND TRIMMING HOURS FOR DISTRIBUTION OF CUTTING DIVISION EXPENSE
												31		TOTAL AMOUNT OF WAGES AND SALARIES FOR DISTRIBUTION OF MAKING DIVISION EXPENSE
												36		TOTAL MANUFACTURING COST OF WORKED MATERIALS FINISHED THIS PERIOD
												38		TOTAL AMOUNT OF PRO-RATED SELLING EXPENSE DISTRIBUTED
												39		TOTAL SELLING COST OF WORKED MATERIALS FINISHED THIS PERIOD
							TOTAL SELLING COST OF EXTRA TROUSERS FINISHED	TOTAL SELLING COST OF SUITS FINISHED.	TOTAL SELLING COST OF OVERCOATS FINISHED.					
												37		TOTAL MAKING COST OF WORKED MAT. FOR DISTRIBUTION OF PRO-RATED SELLING EXPENSE
												40		TOTAL POSSIBLE HOURS
												41		TOTAL IDLE HOURS FOR SPONGING, CUTTING, AND MAKING DIVISIONS.
												42		
												43		TOTAL AMOUNT TO BE DEDUCTED FOR IDLE TIME FROM TOTAL OF ALL EXPENSES

period, divided into five sub-divisions: Wages, Salaries, Stores, Miscellaneous Items and Prorated Items. Wages and salary items are furnished by the Payroll Division in the form of a tabulated recapitulation of the payroll for the period. Stores items are obtained from stores issues, or requisitions on the stores division, for stores used during the period. Miscellaneous items are those involving expenditures other than for labor and material, such as telephone and telegraph charges, drayage charges, subscriptions, and outside services of various kinds. Prorated items are miscellaneous items paid or estimated in advance, such as insurance, taxes, interest, etc., which must be distributed over an entire season or year. Both miscellaneous and prorated items are furnished at the close of each period by the Accounting Department.

After all expenses have been collected and posted opposite their proper account symbol on the analysis sheet, the figures in each column are added into subdivisional totals, which are then added into divisional totals, and these are finally added into totals for their main headings, A, B, C, D or E. The illustration shows figures opposite and symbols representing individual accounts, totaled for each sub-division, totaled again into main divisions (A, D & A, E) and finally totaled opposite the main heading (A). On the right hand side of the sheet, and opposite each account are figures comparing the present period with the previous one, and the cumulative total to date with the budget to date.

The value of this Detailed Expense Analysis for the purpose of making an intensive study of the cost of any activity or group of activities is self-evident. It is also invaluable as a basis for budgeting expense for any future period of time.

Now that we have gathered the expenses under their proper headings we can proceed to the other two groups, Product and Construction, and distribute the expenses over these groups. Figure 7 shows the Expense Distribution Sheet for one period. This form, as you will recognize, is based on the familiar Taylor Distribution Sheet as perfected by Mr. Carl G. Barth. In fact we are greatly indebted to Mr. Barth for his personal assistance in making the final revision of this form. The symbols at the head of the various columns indicate the class of expenditures to be entered in each column, and are also used for reference purposes in the instructions appearing on the left side of the page. The columns are arranged in order so that the distribution, beginning with the left hand column E, proceeds systematically toward the right by consecutive steps, as indicated by the line numbers and explained in the instructions. This process of distribution continues until all expenses find their way into totals to be added to inventories of Construction, Work in Process, or Finished Product.

To facilitate the explanation we have divided the sheet into six horizontal sections marked 1 to 6 (under heading "Posted by"). In Section 1 we list all expenditures for the period under their proper headings. The items to be posted in this section are obtained from the detailed analysis of expense just explained, from stores issues for materials for construction or product, and from the payroll division for direct labor used on construction or on product. This information as to wages for district labor is furnished by the payroll division in the form of individual daily summaries for each employee so engaged, and is distributed by the Statistical Division over the various types of product manufactured before being entered on the Expense Distribution Sheet.

In Section 2, all expenses, except selling expense, are distributed over Construction and Work in Process Accounts. In Section 3 are computed the various rates to be used in making the distribution in Section 2. In Section 4 the selling expense is distributed over finished product accounts. In Section 5 is computed the rate to be used in distributing Selling Expense in Section 4. Section 6 is a supplementary one for the purpose of demonstrating what part of each main expense group might logicaly be charged to profit and loss instead of to the product itself, because, due to lack of orders, lack of materials or other contributing causes, a certain part of the time available for manufacturing has not been used for that purpose.

In leaving this expense distribution, which serves as a basis for journal entries to the general accounting system, I should like to touch briefly on what might properly be called one of its by-products. In the individual summaries of wages paid for direct labor furnished by the Payroll Division, we have the data for an extremely interesting and valuable comparison of divisional performance. In addition to the piece work wages, which is the basic payment for production, quality, attendance, etc., there is a number of different kinds of bonuses and retainers. By means of the summaries referred to above, we collect data showing the proportion of the total payroll devoted to piece work, bonuses, and other forms of remuneration, for each manufacturing division. These data are charted to show the comparative performances of the various divisions, as well as the

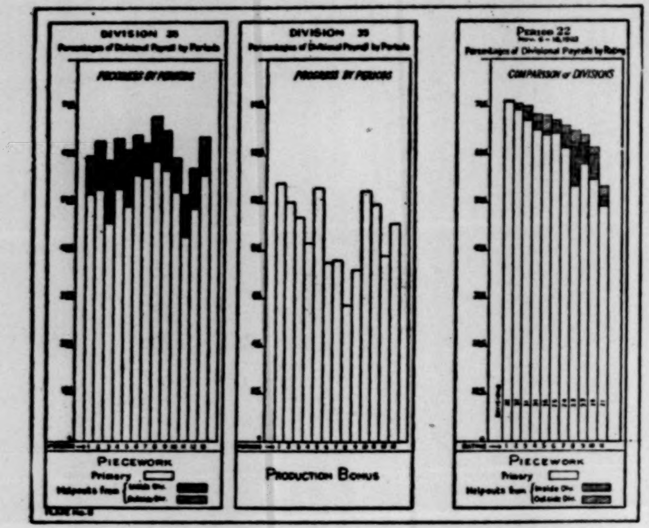

Fig. 8. Chart of Comparative Performance.

progress made from period to period by the individual divisions and by the shop as a whole. These charts, of which Figure 8 is an example, are of obvious value, both to the management and to the foremen of the various divisions. Furthermore, this same information, used in connection with reports of divisional production furnished by the Routing Division, enables us to chart in a similar manner the unit wage cost of the product for each manufacturing division, both as a whole, and divided into its various wage components.

The mechanical method of analyzing these payroll summaries to obtain the data for the above charts may be a matter of some interest. Up to the present time this sorting has been done by means of punched cards, similar to those used in handling Personnel Data and Sales Statistics, and the results have been very satisfactory. However, it has been found that the labor of punching and verifying a large number of cards, and the rental of the additional machinery required, was hardly justified in view of the fact that the cards, after once being used, were of no further value. We have just installed what might be described as a modification of, or rather a new development of, a cash register machine, by which the items of pay may be charged, simultaneously, to one of several accounts representing class of product, to one of a number of accounts representing class of wage, and to a controlling grand total. In fact the machine will carry twenty-seven simultaneous totals and will give a total for any one or all of them whenever desired. This work is done daily and serves two additional purposes. It acts as a daily audit on the work of the payroll division, and it enables us each day to furnish each employee with a detailed statement of his earnings for the preceding day and for the period.

Before concluding this paper it might be well to answer in advance one question that is sure to be asked: What does a statistical division cost? The answer to that question depends upon the size of the division and the nature and amount of apparatus used, and those in turn are dependent on the size of the organization, and the number, kind and extent of the reports and analyses required. For our organization the cost, in payroll alone, is approximately nine-tenths of one per cent of the total payroll; the total cost, including payroll, supplies and royalties on apparatus used, amounts to about two-thirds of one per cent of the total operating cost. But, after all, the question should be, not "What does it cost?" but "Is it worth what it costs?" In our case the answer is without qualification, "Yes." This answer is not based solely on the fact that the output of the division is less expensive than it would be if it came directly from several widely separated sources, though with us that is the case. It also takes into consideration the much more important fact that by means of combining all statistical functions into one unit, much information is obtained which would otherwise be unavailable, and that by virtue of such information, we are able to make savings in many different directions. The extent of such savings is often difficult of demonstration, but that they are made and are of considerable amount is unquestioned.

In conclusion a few words as to why we consider this compilation of statistics a distinct function of scientific management.

Frederick W. Taylor in "Shop Management," paragraphs 149 and 150, lays down the following principles:

> "First: *A Large Daily Task.* Each man in the establishment, high or low, should daily have a clearly defined task laid out before him. This task should not in the least degree be vague nor indefinite, but should be circumscribed carefully and completely, and should not be easy of accomplishment.
>
> "Second: Standard Conditions. Each man's task should call for a full day's work, and at the same time the workman should be given such conditions and appliances as will enable him to accomplish his task with certainty."

Another principle, and one which everyone tries to follow, is that whenever a job is to be done, the man to whom it is given should be the one best fitted to do it.

It is our belief that a separate statistical division is the only means by which statistical information can be compiled and presented in conformity with the above principles. By concentrating this work into one unit, we are able to provide expert supervision, to select a specially qualified personnel, and to train them to do the work more accurately and expeditiously than if they were only called upon to do it occasionally and in addition to other duties. We are able to furnish this personnel with all available data, with the most modern machinery for handling it, and with the proper facilities for filing it. And we are able to plan the work intelligently. We can tell in advance what reports are wanted, and when they are wanted. We can eliminate duplication of effort by eliminating reports furnishing the same information as that given by other more necessary ones. We can combine into one report data originating in various sources and thus avoid a number of reports by separated departments, in which much of the information must necessarily be repeated. And we are in a position to make an immediate response to any sudden or irregular request for special information.

And finally we are able to do this work more smoothly, more quickly, more accurately and at less expense than we can do it in any other way. We regard the gathering, compilation, and distribution of statistical information as a distinct function of scientific management, and believe we are justified in organizing a separate department for the sole purpose of performing that function.

I ASKED the director and his associates of the Central Institute of Research at Karlsruhe what they think of the application of Taylor methods in Germany.

They at once called my attention to the fact that detail elemental time study of the work of the artisan is extremely difficult, and probably not worth while, because the conditions of work vary so greatly in the small industries.

I then asked what they think of the utilization of the Taylor system in the larger industries. They replied that it is desirable not to accept hastily any particular system, but to first consider it in a spirit of reasonable criticism. They seemed to believe (what is certainly an error to one who has studied carefully the work of Taylor and his followers[1]) that the Taylor system transforms a worker into a machine, a worker who has lost interest in his work, and that it would be impossible to develop the system among the workers of Germany. I believe that, judging by this opinion, they have been badly informed concerning recent American developments of Taylor management, in which the interest of the worker has been given primary consideration.

They acknowledge, nevertheless, that Taylor is the real founder of the great movement towards a practicable scientific study of management, and they affirm that in the majority of German industries the function of planning and preparation of work is very advanced; that the forms which pass from process to process to specify the necessary materials and tools for the processing of a predetermined lot are utilized in a large number of establishments; and that it is likewise recognized that a knowledge of the *time* necessary to perform a given task would permit a rational study of work, a circumstance of great importance in the face of the present extremely variable wage conditions. They note on work order slips the time which should be taken for the job and later the time actually taken, but is not customary to base wage payments on a scientific time study of operations. The latter, they say, is difficult because opposed by the workers' organizations.

Management is not able to accomplish all its desires, but it seems that gradually managers and workers are returning to the piece rate system, and analyses of the resultant actual times of operations is permitting the reasonably rapid development of progressive methods. (Translation of an address of M. Antoine, Civil Engineer, France, before the Foundation Michelin; from *Le Genie Civil,* 26 August, 1922.)

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[1] The author had just returned from an extended tour of investigation in the United States.

THE ORGANIZATION AND MANAGEMENT OF A MEDIUM-SIZED PLANT[1]

THE CORONA TYPEWRITER COMPANY, INC.

By Percy S. Brown[2]

I. NATURE OF THE PRODUCT

THE Corona Typewriter Company, manufactures only a portable typewriter, the case in which it is carried, and a few accessories such as folding stands and label holders. Furthermore, as only one model is manufactured, this paper deals with a specific type of manufacture; the continuous producing of Coronas and their cases. Our system of organization and methods of manufacturing control would probably be only slightly applicable in plants where there are a great variety of products manufactured.

Our problem is to produce finished Coronas of the highest quality in large quantities in the most economical way, and in order to do this we have found it expedient to highly departmentalize and thoroughly functionalize the entire organization. Going further, we have taken individual departments and have studied and standardized every operation performed in the department. Standardization has necessarily had to be thorough and far reaching.

We divide our manufacturing into two parts: First, we manufacture parts to finished parts stock, and, second, we assemble machines from this stock. Our parts manufacturing departments are composed of various machine departments, various finishing departments and a bench assembly department where parts are adjusted before being stocked, springs are made and other operations performed which cannot be readily assigned to other departments. In addition to these departments we classify under parts manufacturing all inspection work performed on parts, as well as the tool room and wood shop.

Owing to the nature of our manufacturing problem we have been able so to route the flow of parts that it is with few exceptions continuous from the first to the fourth floor of our Groton plant, from there to our Cortland plant and back to the fourth floor of our Groton plant. There is a comparatively small amount of back flow of parts from a higher to a lower floor, though occasionally this is brought about because it would be unwise to place certain special machines in the department where they would not be utilized continuously, when another department is equipped and has the capacity for performing the work. In an enterprise like ours back flow is not so important a factor, however, as in a factory manufacturing large, heavy products, as a pan containing thousands of typewriter parts may weigh only a few pounds.

II. GENERAL ORGANIZATION

The entire organization from president down has been highly functionalized and the result has been increased individual and group efficiency (Fig. 1). In this connection the following explanation of the functionalizing of factory departments may prove of interest:

1. The factory has to be properly heated, equipped with line shafts and pulleys, motors, power, etc. It must be properly inspected, watchmen provided, millwrights and electricians must be available, cleanliness maintained and adequate safeguards provided against accident to employees. The responsibility for this work is placed on the works engineer.

2. We must next provide the machinery and tools to perform manufacturing operations. These details are under the supervision of the production equipment engineer.

3. The material must be available in order to manufacture parts. It is secured by the purchasing department.

4. We must provide the men and women to operate the machines. This is a function of the employment department.

5. Now, being ready for production we must utilize a planning and control division, which studies operators, sets rates, determines methods of manufacturing, establishes adequate control of stores, and a system of scheduling, routing, dispatching and time keeping on all operations. These are major functions of the planning engineer and his division heads.

6. Next we must provide skilled supervisors for each department and such supervisors must not only be thoroughly familiar with all manufacturing operations under their control but must also be competent instructors on all operations and close observers of quality. Each supervisor reports directly to the works manager, though his functions are dictated largely by the planning department.

7. Though we place primary responsibility for quality with the supervisor and secondary responsibility on the operator, we provide for both walking and detail inspection of parts as well

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[1] Paper presented at a meeting of the Taylor Society, New York, Nov. 23, 1922.

[2] Works Manager.

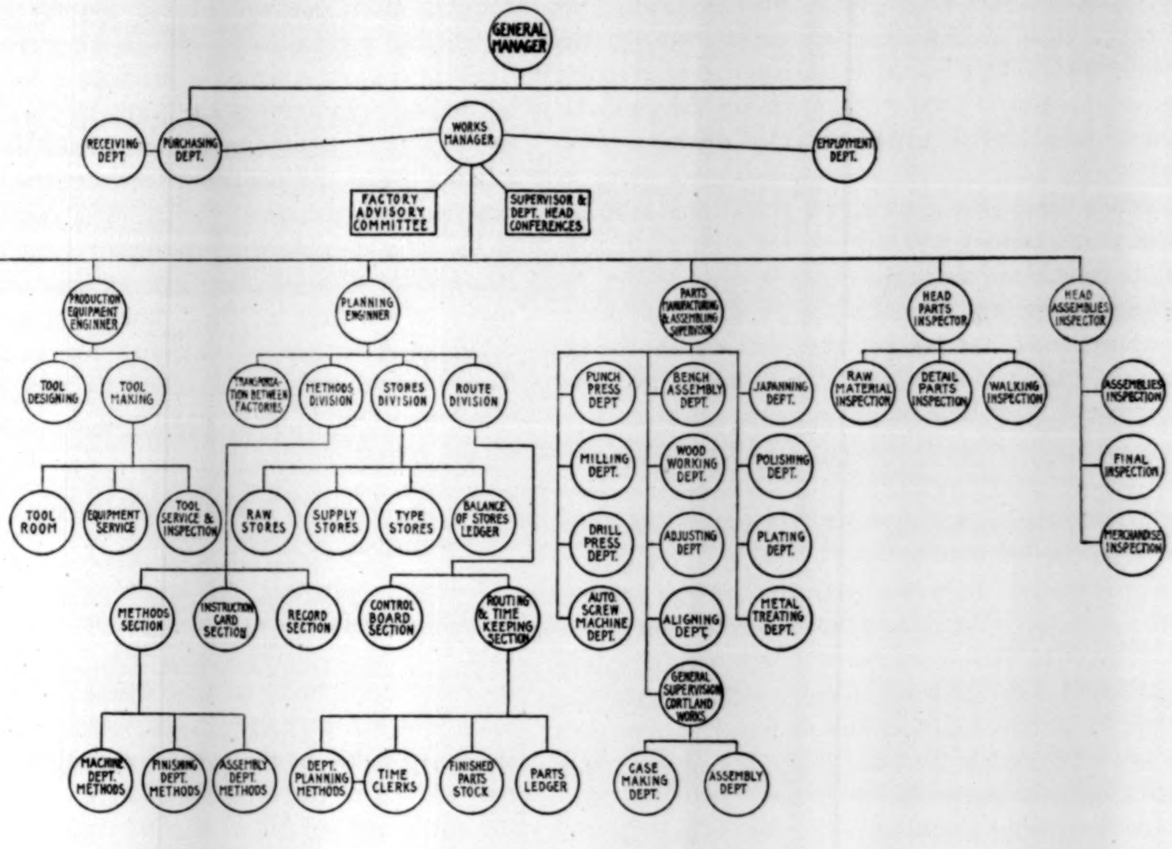


Fig. 1. Manufacturing Organization Chart.

as inspection of raw materials. We, therefore, have a head parts inspector.

8. Because of the great difference between parts inspection and assemblies inspection we have found it advisable to have a head assemblies inspector who is responsible for all assembling operations and the quality of the finished product. He also handles the inspection of such merchandise as we handle, for example, special luggage of all kinds made for the Corona.

The works manager has as his consultants on factory matters two groups: The first is known as the factory advisory committee which consists of all heads of departments described above, except supervisors, together with the head of the service department, and the head of the experimental and designing department, both of which are under the general manager and only indirectly connected with the factory organization. The head of the methods division of the planning department is also a member of the committee. The committee considers and passes on all major factory problems and meets semi-monthly and at any time on call of the works manager. At times there will be one meeting every two weeks and at other times there may be three or four.

The other advisory body is composed of all supervisors, and all members of the factory advisory committee. These conferences are bi-monthly and are open forums for the discussion of any topics of general interest. They also enable the management to present information on sales, costs, items of expense, publicity methods and other matters which ordinarily are not brought to the attention of foremen, but which are of vital interest to them and tend to stimulate enthusiasm and inspire confidence. Our supervisors conferences are addressed periodically by the president, general manager, sales manager and other officials of the company and, like the conferences which are purely for consideration of factory problems, these are always open forums for general discussion after the informal talk.

III. DETERMINATION OF SALES, PRODUCTION AND FINANCIAL SCHEDULES

The world is our market and every individual old enough to read and write is a possible prospect. We therefore have a research division of our sales organization, which maintains records of all sales made within definite sales territories, together with such facts as population, rural and urban, per capita wealth, etc. This information together with estimates as to probable business activities is used in determining the probable volume of sales that should be expected during a given period.

Based on these sales estimates a production schedule is given to the factory organization for as many months ahead as conditions warrant.

Detailed budgeting, or estimating in detail our financial requirements, has not yet been introduced, though a general forecast is made and a cash budget prepared and corrected from time to time.

IV. SELLING METHODS

As a rule when speaking of a typewriter one is apt to think of the large office type of machine. There is, however, a marked difference between the large machine and the portable. With the former the field is practically limited to business offices where stenographers are employed. In the case of the portable typewriter no such limitations exist, as the majority of machines are sold to individuals for their personal use, for either social or business purposes. It is therefore quite obvious that the selling problems of the two classes are essentially different.

Office machines are rarely sold from a store, but are distributed almost exclusively through salesmen, while portable machines are to a large extent sold in stores. Outside salesmen do not assume the same importance as in the case of large machines. In order to secure any large volume of business under these conditions a relatively large number of dealers are necessary, and as service is a very important factor in the merchandising of the portable typewriter, it is also necessary that the distributors, in the large cities at least, maintain thoroughly equipped repair departments in charge of competent mechanics. In order that the dealer may be induced to maintain such a service department, we consider it essential that he be given exclusive control of a specific territory.

It is plain that with us retail selling is a function of the dealer rather than the home office. In order that we may exercise better control over our dealers we have grouped them into geographical divisions, each division being under the supervision of a division manager who reports directly to the sales manager and who regularly visits all dealers in his division. We also have a traveling service man, reporting regularly and in detail to the home office service department and traveling from one end of the country to the other, instructing service men, and checking complaints.

As an aid to the dealer in developing his territory and his selling organization, the work of the division managers is supplemented by bulletins from the home office, a house organ and occasional conventions. Dealers are supplied with the usual variety of advertising material, including a monthly window display service. While the home office does not bear the expense of local newspaper advertising, it does, where requested, plan all details and supply all material for such campaigns. This local advertising is backed up by a consistent national campaign in the general magazines at the expense of the company.

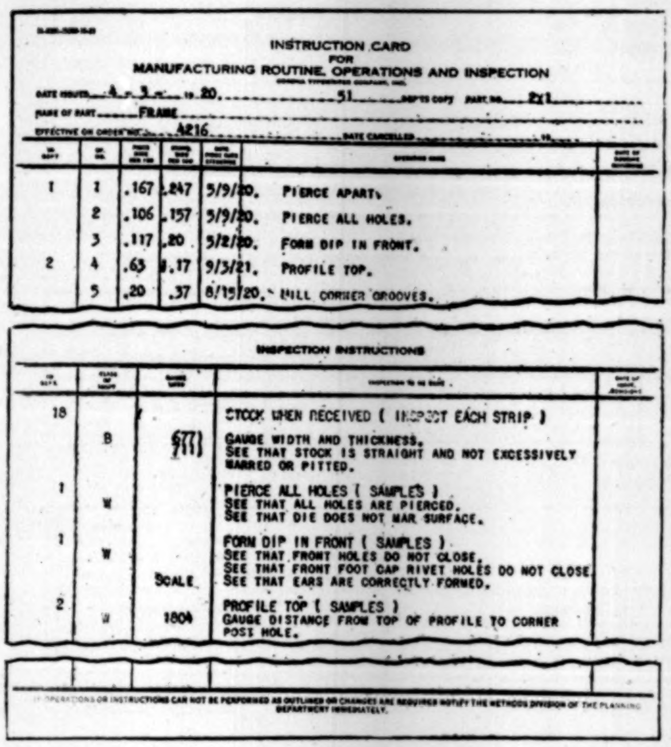
V. MANUFACTURING

1. *Organization on the Basis of Processes*

In many industries the organization is built around certain manufacturing units where a specific product may be manufactured completely. In such industries it is not uncommon to find numerous manufacturing units which are practically complete in themselves although possibly in the same building, and where there may be two or three machine shops, a number of plating or japanning rooms, etc. In our factory we have attempted to thoroughly departmentalize all processes so that all similar operations shall be performed in the same department. For instance, we concentrate all milling operations in the milling department, all punch press operations in the punch press department. There are only a few instances where this plan is not strictly followed. Thus frames have certain operations performed on them before being sent to the drill press department and then they have polishing, bending, riveting and other operations performed upon them in the same department. We do this in order to reduce inventories and to avoid carrying large cushions of comparatively cumbersome and expensive parts.

In order to give some idea of the number of parts manufactured and operations performed, a little data might be of interest. We have recently improved Corona and have not yet compiled this data for the improved model, and I am therefore giving it for the No. 3 model, of which nearly 500,000 have been marketed in the past ten years.

There are 671 parts on the typewriter, 139 on the case, 110 on the folding stand, a total of 920 parts. There are 355 *different* parts on the typewriter, 61 on the case and 37 on the stand, a total of 453 *different* parts. There are 1999 manufacturing operations on the



INSTRUCTION CARD
FOR
MANUFACTURING ROUTINE, OPERATIONS AND INSPECTION

DATE ROUTED 4-3- 19 20. 51 DEPT'S COPY PART NO. 2X1
NAME OF PART FRAME
EFFECTIVE ON ORDER NO. A216 DATE CANCELLED 19

1	1	.167	.247	5/9/20.	PIERCE APART.	
	2	.106	.157	5/9/20.	PIERCE ALL HOLES.	
	3	.117	.20	5/2/20.	FORM DIP IN FRONT.	
2	4	.63	1.17	9/3/21.	PROFILE TOP.	
	5	.20	.37	8/15/20.	MILL CORNER GROOVES.	

INSPECTION INSTRUCTIONS

18			STOCK WHEN RECEIVED (INSPECT EACH STRIP)	
	B	6771	GAUGE WIDTH AND THICKNESS. SEE THAT STOCK IS STRAIGHT AND NOT EXCESSIVELY MARRED OR PITTED.	
1	W		PIERCE ALL HOLES (SAMPLES) SEE THAT ALL HOLES ARE PIERCED. SEE THAT DIE DOES NOT MAR SURFACE.	
1	W	SCALE	FORM DIP IN FRONT (SAMPLES) SEE THAT FRONT HOLES DO NOT CLOSE. SEE THAT FRONT FOOT CAP RIVET HOLES DO NOT CLOSE. SEE THAT EARS ARE CORRECTLY FORMED.	
2	W	1804	PROFILE TOP (SAMPLES) GAUGE DISTANCE FROM TOP OF PROFILE TO CORNER POST HOLE.	

IF OPERATIONS OR INSTRUCTIONS CAN NOT BE PERFORMED AS OUTLINED OR CHANGES ARE REQUIRED NOTIFY THE METHODS DIVISION OF THE PLANNING DEPARTMENT IMMEDIATELY.

Fig. 2. Operation Routine Card, Front and Back.

typewriter, 210 on the case, and 205 on the stand, a total of 2,414 operations, exclusive of inspection. To these must be added 38 sub-assembly operations and 15 assembly operations, a total of 53 assembly operations, and a grand total of 2,467 operations of all kinds, exclusive of inspection. If inspections are added, the total number of operations performed amount to approximately 4,600.

2. *Control of Operations*

(a) Standardization

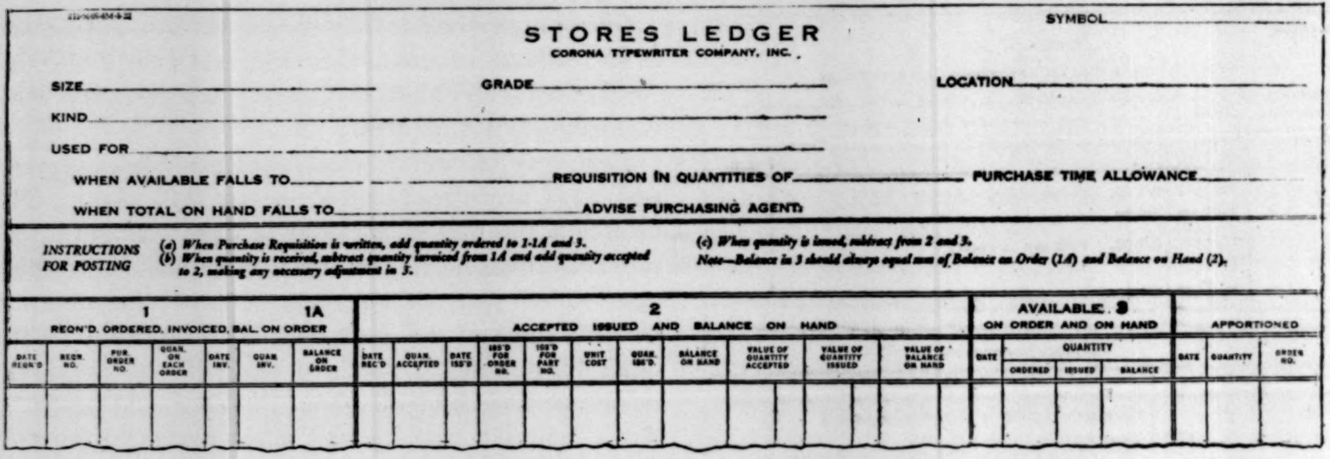
Mechanical Methods. All methods are carefully studied by the methods division of the planning department before manufacturing routines are written, and these studies are supposed to be sufficiently exhaustive so that few changes, if any, will have to be made once they have been established as standard practice. In establishing these routines the methods division consults with the experimental and designing department and with the production equipment engineering department, gathering together all of the necessary data bearing on the material and tools. Based on the information gathered the data is written up on operation routine cards (Fig. 2) which contain the routine of all parts and give the various operations performed on the parts, including all inspection necessary.

Chemical Methods. The same procedure is followed as in the case of mechanical methods except that instead of a highly skilled mechanical technician the work is in charge of a chemist.

Tools and machines. In so far as possible all production tools are manufactured in our own plant. The only time that this is not done is when changes in design may be made and the time is quite limited, in which case, rather than enlarge our tool room temporarily, we send some of the work outside. Machinery on the other hand is never specially made if we can secure results with a standard product. We should prefer to buy a standard machine and adapt it to special needs rather than to make it or have it made specially to our design. With machines we endeavor to hold to close standardization so that we may have as many machines of like design and capacity as possible, but with tools we endeavor to specialize highly in order to secure maximum production of the highest quality at the lowest cost. Tools are designed by the tool designing division of the production equipment engineering department from part blue prints furnished by the experimental and designing department, which is not a part of the factory organization but belongs to the general administrative organization. (It is, in fact, the engineering department of our industry in so far as engineering is applied to the construction and operation of a typewriter). Machines are grouped so that routing is facilitated through our being able to route work to any machine in a group.

Designing, building and issuing production tools. Whenever a new part or design is released by the experimental department a sample part and blue print of the part are issued by them, giving tolerances and size, and grade of stock to be used. These are sent to the production equipment engineering department so that the necessary tools for manufacturing may be designed. After the tools are designed, the prints are issued to the tool room and the tools built. Upon completion and inspection of each tool, sample parts are submitted to the experimental and designing department for approval, and when they are approved the tool is turned over to the methods division of the planning department who set up and operate the tool and issue the proper routine instruction card covering its use. The sample parts made by the tool must be approved by the parts inspection department before the tool may be placed in the tool crib available for production.

All tools and gauges are numbered, and stored in the tool crib by operations, so that in ordering out



SYMBOL

STORES LEDGER

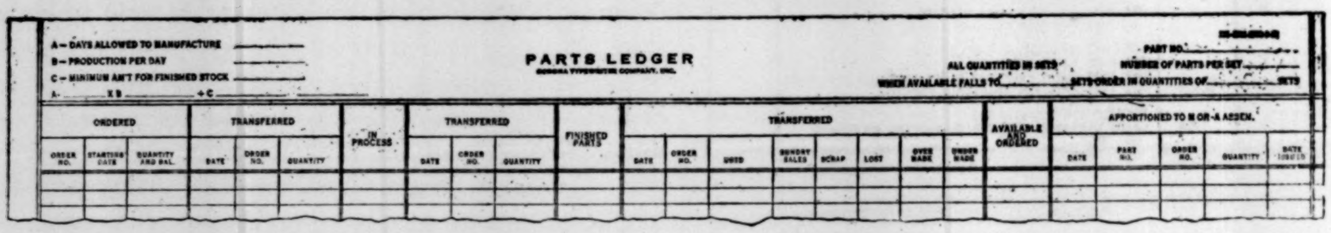
CORONA TYPEWRITER COMPANY, INC.

SIZE
GRADE
LOCATION
KIND
USED FOR
WHEN AVAILABLE FALLS TO
REQUISITION IN QUANTITIES OF
PURCHASE TIME ALLOWANCE
WHEN TOTAL ON HAND FALLS TO
ADVISE PURCHASING AGENT

INSTRUCTIONS FOR POSTING (a) When Purchase Requisition is written, add quantity ordered to 1-1A and 3. (b) When quantity is received, subtract quantity invoiced from 1A and add quantity accepted to 2, making any necessary adjustment in 3. (c) When quantity is issued, subtract from 2 and 3. Note—Balance in 3 should always equal sum of Balance on Order (1A) and Balance on Hand (2).

1 REQN'D. ORDERED, INVOICED, BAL. ON ORDER						1A	2 ACCEPTED ISSUED AND BALANCE ON HAND											AVAILABLE 3 ON ORDER AND ON HAND				APPORTIONED		
DATE REQN'D	REQN. NO.	PUR. ORDER NO.	QUAN. ON EACH ORDER	DATE INV.	QUAN. INV.	BALANCE ON ORDER	DATE REC'D	QUAN. ACCEPTED	DATE ISS'D	ISS'D FOR ORDER NO.	ISS'D FOR PART NO.	UNIT COST	QUAN. ISS'D.	BALANCE ON HAND	VALUE OF QUANTITY ACCEPTED	VALUE OF QUANTITY ISSUED	VALUE OF BALANCE ON HAND	DATE	QUANTITY			DATE	QUANTITY	ORDER NO.
																			ORDERED	ISSUED	BALANCE			

Fig. 3. Balance of Stores Ledger.



A— DAYS ALLOWED TO MANUFACTURE
B— PRODUCTION PER DAY
C— MINIMUM AM'T FOR FINISHED STOCK
A- X B + C

PARTS LEDGER

CORONA TYPEWRITER COMPANY, INC.

PART NO.
ALL QUANTITIES IN SETS
NUMBER OF PARTS PER SET
WHEN AVAILABLE FALLS TO SETS ORDER IN QUANTITIES OF SETS

ORDERED			TRANSFERRED			IN PROCESS	TRANSFERRED			FINISHED PARTS	TRANSFERRED								AVAILABLE AND ORDERED	APPORTIONED TO M OR -A ASSEM.				
ORDER NO.	STARTING DATE	QUANTITY AND BAL.	DATE	ORDER NO.	QUANTITY		DATE	ORDER NO.	QUANTITY		DATE	ORDER NO.	USED	SUNDRY SALES	SCRAP	LOST	OVER MADE	UNDER MADE		DATE	PART NO.	ORDER NO.	QUANTITY	DATE ISSUED

Fig. 4. Parts Control Ledger.

tools it is only necessary to specify those needed for a certain operation and part number. Upon the completion of an operation all tools, together with from fifteen to twenty-five of the last parts made by each tool and a tool service slip giving the number of parts made and commenting on the condition of the tool, are sent to the tool inspection section. A careful inspection is made and if any defects are found the tool is immediately sent to the tool room to be conditioned. Upon completion of the conditioning of the tool it is returned to the tool inspection section, is again inspected, and if approved is placed in its proper location in the tool crib with the last parts made and is ready for use.

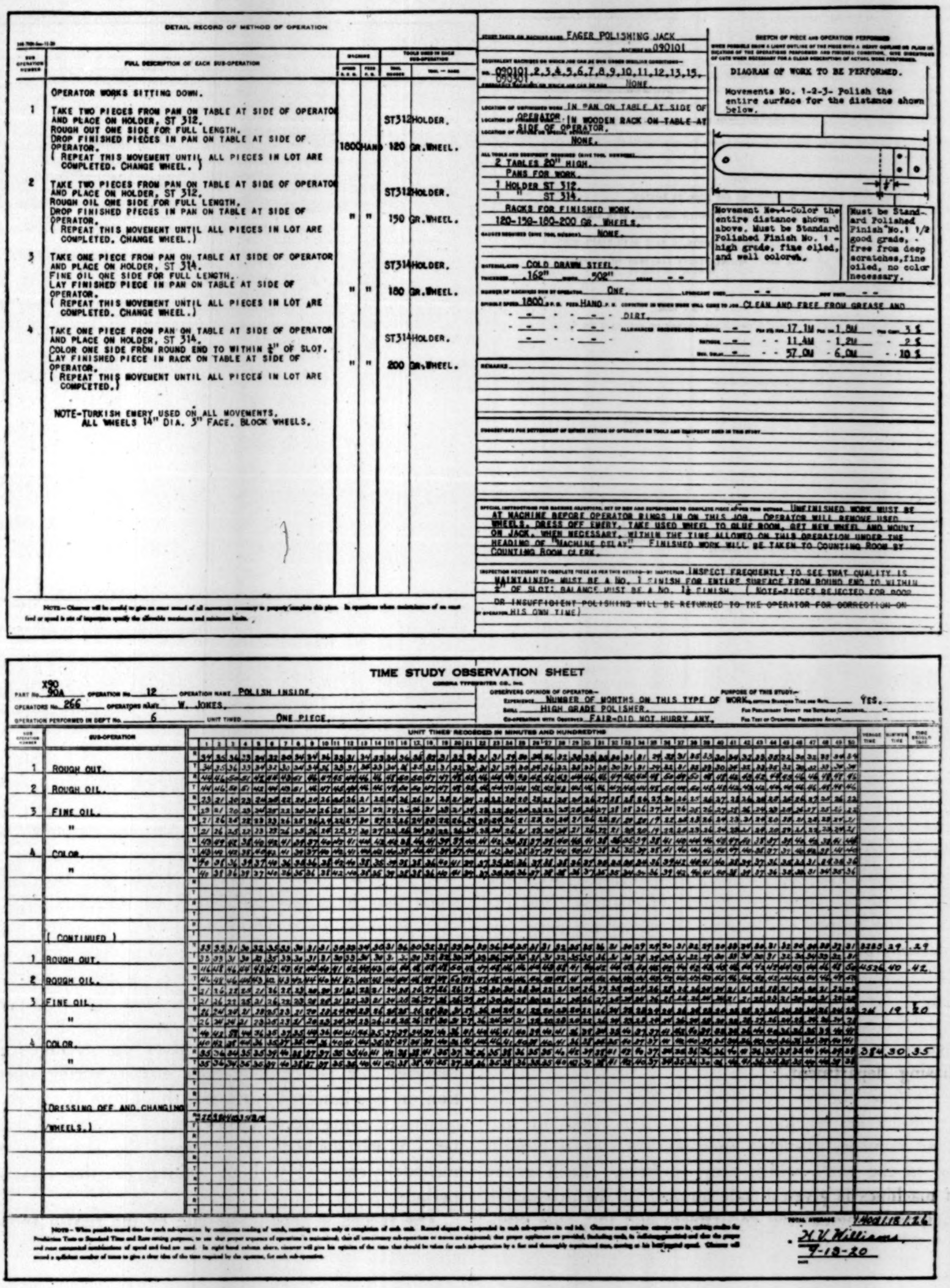
(b) Classification

Product. Our machine is made up of parts which we manufacture from raw material, parts which we purchase ready for immediate use (these being parts such as key rings, which we can buy in great quantities very much cheaper than we can make them), and purchased parts on which we have to perform some manufacturing operations, as for example, rubber platens. Our routine cards show exactly what classification the parts belong in and what manufacturing operations, if any, are performed.

Parts which we buy and on which no operations are performed are ordered from a balance of stores ledger (Fig. 3) the same as raw material and are sent directly into finished parts stock. Parts which we purchase and on which we do perform manufacturing operations are treated as raw material and are carried on the balance of stores ledger. All parts, no matter what their classification, are carried in a parts control ledger (Fig. 4) with a sheet assigned to each part number.

Details of the use of the parts control ledger are given under the description of our planning methods.

Operation Control. All operations for each part, with information as to the department in which each process is performed, are contained in a routine card made up by the methods division. This has been described under "STANDARDIZATION—Mechanical Methods." The routine of handling work in planning centers is given in the planning center clerk instruction sheet which shows the standard time keeping methods which have been found best in facilitating the work of costing and pay roll keeping, and the methods of properly handling, counting, and moving the work through the various manufacturing operations. Major planning is handled by the control board section of the route division of the planning department. This section posts on its control board the various manufacturing orders with lot sizes, time for completing the work and group of machines on which the work is to be performed. The instruction cards issued to the operators for all operations are described elsewhere.



DETAIL RECORD OF METHOD OF OPERATION

	OPERATOR WORKS SITTING DOWN.				
1	TAKE TWO PIECES FROM PAN ON TABLE AT SIDE OF OPERATOR AND PLACE ON HOLDER, ST 312. ROUGH OUT ONE SIDE FOR FULL LENGTH. DROP FINISHED PIECES IN PAN ON TABLE AT SIDE OF OPERATOR. (REPEAT THIS MOVEMENT UNTIL ALL PIECES IN LOT ARE COMPLETED. CHANGE WHEEL.)	1800	HAND	ST312 120	HOLDER. GR. WHEEL.
2	TAKE TWO PIECES FROM PAN ON TABLE AT SIDE OF OPERATOR AND PLACE ON HOLDER, ST 312. ROUGH OIL ONE SIDE FOR FULL LENGTH. DROP FINISHED PIECES IN PAN ON TABLE AT SIDE OF OPERATOR. (REPEAT THIS MOVEMENT UNTIL ALL PIECES IN LOT ARE COMPLETED. CHANGE WHEEL.)	"	"	ST312 150	HOLDER. GR. WHEEL.
3	TAKE ONE PIECE FROM PAN ON TABLE AT SIDE OF OPERATOR AND PLACE ON HOLDER, ST 314. FINE OIL ONE SIDE FOR FULL LENGTH. LAY FINISHED PIECE IN PAN ON TABLE AT SIDE OF OPERATOR. (REPEAT THIS MOVEMENT UNTIL ALL PIECES IN LOT ARE COMPLETED. CHANGE WHEEL.)	"	"	ST314 180	HOLDER. GR. WHEEL.
4	TAKE ONE PIECE FROM PAN ON TABLE AT SIDE OF OPERATOR AND PLACE ON HOLDER, ST 314. COLOR ONE SIDE FROM ROUND END TO WITHIN ½" OF SLOT. LAY FINISHED PIECE IN RACK ON TABLE AT SIDE OF OPERATOR. (REPEAT THIS MOVEMENT UNTIL ALL PIECES IN LOT ARE COMPLETED.)	"	"	ST314 200	HOLDER. GR. WHEEL.
	NOTE-TURKISH EMERY USED ON ALL MOVEMENTS. ALL WHEELS 14" DIA. 3" FACE. BLOCK WHEELS.				

EAGER POLISHING JACK

090101

090101, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 090301

NONE.

IN PAN ON TABLE AT SIDE OF OPERATOR.

IN WOODEN RACK ON TABLE AT SIDE OF OPERATOR.

NONE.

2 TABLES 20" HIGH.
PANS FOR WORK.
1 HOLDER ST 312.
1 " ST 314.
RACKS FOR FINISHED WORK.
120-150-180-200 GR. WHEELS.

NONE.

COLD DRAWN STEEL.

.162" .502" - -

DIAGRAM OF WORK TO BE PERFORMED.

Movements No. 1-2-3- Polish the entire surface for the distance shown below.

Movement No. 4-Color the entire distance shown above. Must be Standard Polished Finish No. 1 - high grade, fine oiled, and well colored.

Must be Standard Polished Finish No. 1 1/2 good grade, - free from deep scratches, fine oiled, no color necessary.

ONE. - - - -

1800 HAND CLEAN AND FREE FROM GREASE AND DIRT.

-	17.1M	1.8M	3 $
-	11.4M	1.2M	2 $
-	57.0M	6.0M	10 $

UNFINISHED WORK MUST BE AT MACHINE BEFORE OPERATOR RINGS IN ON THIS JOB. OPERATOR WILL REMOVE USED WHEELS, DRESS OFF EMERY, TAKE USED WHEEL TO GLUE ROOM, GET NEW WHEEL AND MOUNT ON JACK, WHEN NECESSARY, WITHIN THE TIME ALLOWED ON THIS OPERATION UNDER THE HEADING OF "MACHINE DELAY." FINISHED WORK WILL BE TAKEN TO COUNTING ROOM BY COUNTING ROOM CLERK.

INSPECT FREQUENTLY TO SEE THAT QUALITY IS MAINTAINED- MUST BE A NO. 1 FINISH FOR ENTIRE SURFACE FROM ROUND END TO WITHIN ½" OF SLOT; BALANCE MUST BE A NO. 1½ FINISH. (NOTE-PIECES REJECTED FOR POOR OR INSUFFICIENT POLISHING WILL BE RETURNED TO THE OPERATOR FOR CORRECTION ON HIS OWN TIME)

TIME STUDY OBSERVATION SHEET

PART No. X90 90A OPERATION No. 12 OPERATION NAME POLISH INSIDE.
OPERATORS No. 266 OPERATORS NAME W. JONES.
OPERATION PERFORMED IN DEPT No. 6 UNIT TIMED ONE PIECE.

OBSERVERS OPINION OF OPERATOR—
NUMBER OF MONTHS ON THIS TYPE OF WORK.
HIGH GRADE POLISHER.
FAIR-DID NOT HURRY ANY.

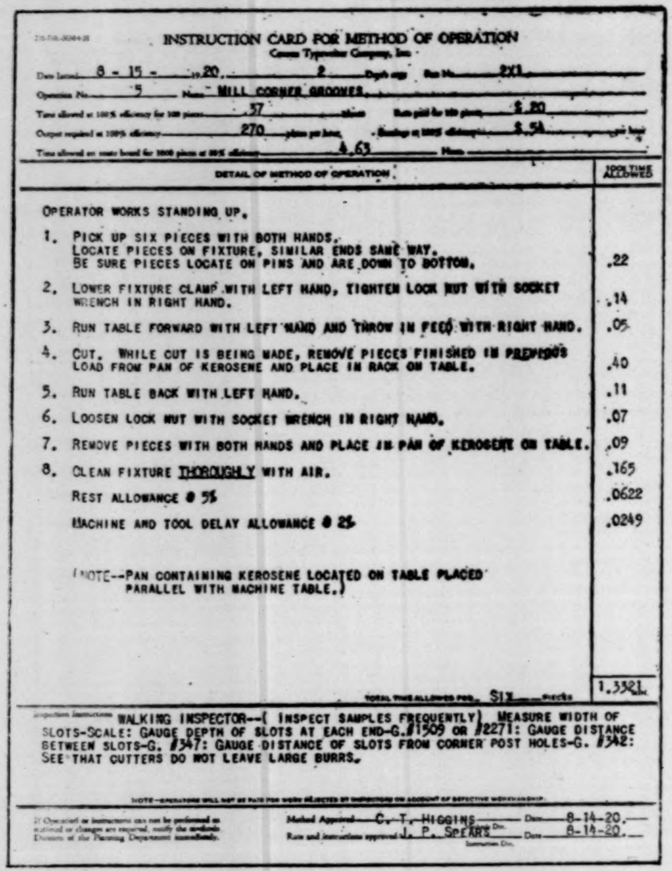
PURPOSE OF THIS STUDY—
YES.

1 ROUGH OUT.
2 ROUGH OIL.
3 FINE OIL.
"
4 COLOR.
"
(CONTINUED)
1 ROUGH OUT.
2 ROUGH OIL.
3 FINE OIL.
"
4 COLOR.
"
(DRESSING OFF AND CHANGING WHEELS.)

1.40 1.18 1.26

H V Williams,
9-13-20

Fig. 5. Time Study Observation Sheet, Front and Back.



INSTRUCTION CARD FOR METHOD OF OPERATION
Corona Typewriter Company, Inc.

Date Issued 8 - 15 - 1920. 2 Dept. 2X1
Operation No. 5 Name MILL CORNER GROOVES.
Time allowed at 100% efficiency for 100 pieces .37 hours Rate paid for 100 pieces $.20
Output required at 100% efficiency 270 pieces per hour. Earnings at 100% efficiency $.54 per hour
Time allowed on route board for 1000 pieces at 80% efficiency 4.63 Hours

DETAIL OF METHOD OF OPERATION	100% TIME ALLOWED
OPERATOR WORKS STANDING UP.	
1. PICK UP SIX PIECES WITH BOTH HANDS. LOCATE PIECES ON FIXTURE, SIMILAR ENDS SAME WAY. BE SURE PIECES LOCATE ON PINS AND ARE DOWN TO BOTTOM.	.22
2. LOWER FIXTURE CLAMP WITH LEFT HAND, TIGHTEN LOCK NUT WITH SOCKET WRENCH IN RIGHT HAND.	.14
3. RUN TABLE FORWARD WITH LEFT HAND AND THROW IN FEED WITH RIGHT HAND.	.05
4. CUT. WHILE CUT IS BEING MADE, REMOVE PIECES FINISHED IN PREVIOUS LOAD FROM PAN OF KEROSENE AND PLACE IN RACK ON TABLE.	.40
5. RUN TABLE BACK WITH LEFT HAND.	.11
6. LOOSEN LOCK NUT WITH SOCKET WRENCH IN RIGHT HAND.	.07
7. REMOVE PIECES WITH BOTH HANDS AND PLACE IN PAN OF KEROSENE ON TABLE.	.09
8. CLEAN FIXTURE THOROUGHLY WITH AIR.	.165
REST ALLOWANCE @ 5%	.0622
MACHINE AND TOOL DELAY ALLOWANCE @ 2%	.0249
(NOTE--PAN CONTAINING KEROSENE LOCATED ON TABLE PLACED PARALLEL WITH MACHINE TABLE.)	
TOTAL TIME ALLOWED FOR SIX PIECES	1.3321

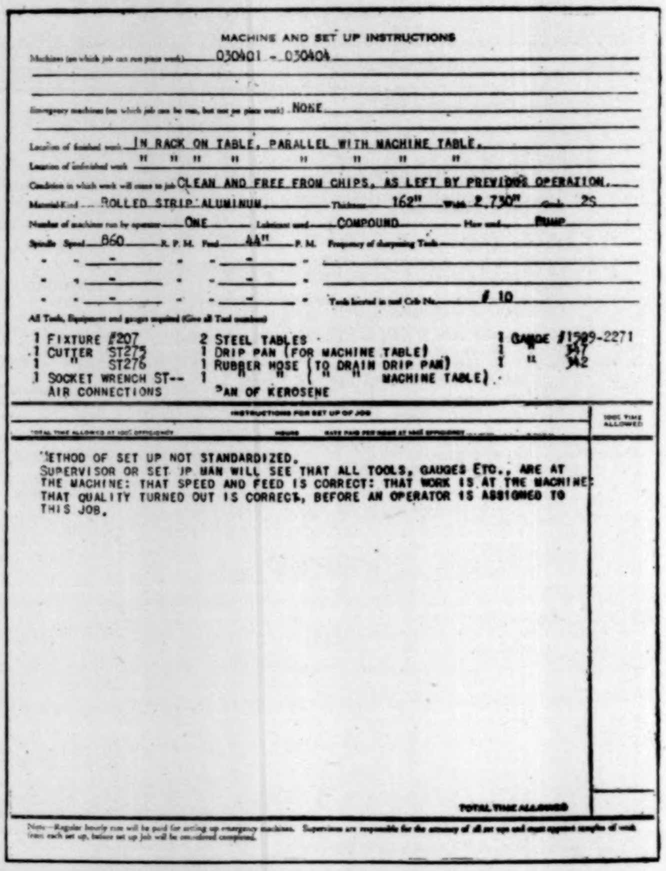
Inspection Instructions WALKING INSPECTOR--(INSPECT SAMPLES FREQUENTLY) MEASURE WIDTH OF SLOTS-SCALE: GAUGE DEPTH OF SLOTS AT EACH END-G.#1509 OR #2271: GAUGE DISTANCE BETWEEN SLOTS-G. #347: GAUGE DISTANCE OF SLOTS FROM CORNER POST HOLES-G. #342: SEE THAT CUTTERS DO NOT LEAVE LARGE BURRS.

NOTE—OPERATORS WILL NOT BE PAID FOR WORK REJECTED BY INSPECTORS ON ACCOUNT OF DEFECTIVE WORKMANSHIP.

If Operation or instructions can not be performed as outlined or changes are required, notify the methods Division of the Planning Department immediately.

Method Approved C. T. HIGGINS Date 8-14-20.
Rate and instructions approved J. P. SPEARS Date 8-14-20.
Instruction Div.

Fig. 6. Instruction Card for Operations, Front.



MACHINE AND SET UP INSTRUCTIONS

Machines (on which job can run piece work) 030401 - 030404
Emergency machines (on which job can be run, but not on piece work) NONE
Location of finished work IN RACK ON TABLE, PARALLEL WITH MACHINE TABLE.
Location of unfinished work " " " " " " " "
Condition in which work will come to job CLEAN AND FREE FROM CHIPS, AS LEFT BY PREVIOUS OPERATION.
Material-Kind ROLLED STRIP ALUMINUM. Thickness 162" Width 2.730" Grade 2S
Number of machines run by operator ONE Lubricant used COMPOUND How used PUMP
Spindle Speed 860 R. P. M. Feed 44" P. M. Frequency of sharpening Tools
" " - " " - "
" " - " " - "
" " - " " - " Tools located in tool Crib No. # 10
All Tools, Equipment and gauges required (Give all Tool numbers)

1 FIXTURE #207	2 STEEL TABLES	1 GAUGE #1509-2271
1 CUTTER ST275	1 DRIP PAN (FOR MACHINE TABLE)	1 " 347
1 " ST276	1 RUBBER HOSE (TO DRAIN DRIP PAN)	1 " 342
1 SOCKET WRENCH ST--	1 " " (" " MACHINE TABLE)	
AIR CONNECTIONS	PAN OF KEROSENE	

INSTRUCTIONS FOR SET UP OF JOB
TOTAL TIME ALLOWED AT 100% EFFICIENCY HOURS RATE PAID PER HOUR AT 100% EFFICIENCY — 100% TIME ALLOWED

METHOD OF SET UP NOT STANDARDIZED.
SUPERVISOR OR SET UP MAN WILL SEE THAT ALL TOOLS, GAUGES ETC., ARE AT THE MACHINE: THAT SPEED AND FEED IS CORRECT: THAT WORK IS AT THE MACHINE: THAT QUALITY TURNED OUT IS CORRECT, BEFORE AN OPERATOR IS ASSIGNED TO THIS JOB.

TOTAL TIME ALLOWED

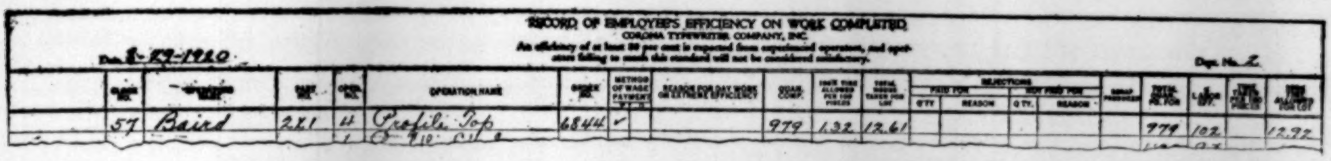
Note—Regular hourly rate will be paid for setting up emergency machines. Supervisors are responsible for the accuracy of all set ups and must approve samples of work from each set up, before set up job will be considered completed.

Fig. 7. Instruction Card for Operations, Back.

Materials. Under this classification we have two important records—part list and material specifications. The part list, as its name implies, gives the part number and name of all parts and sub-assemblies. The material specifications are cards made out in the record section of the methods division from information received from the experimental and designing department and from the production equipment engineering department, the former furnishing data as to size, kind and grade of material, and the latter, the number of pounds required to make one thousand parts, the nature of the material—whether strip, coil, rod, etc. and the lengths that shall be bought for strip, rod or bar stock. These specifications are used by the methods division and stores division of the planning department and by the purchasing department.

Machine Burden Record. In this record we list all production machinery by department and by machine number, grouping machines in classes according to the work which they perform. Each group of machines is given a code number by the production equipment engineering department and this code number readily identifies each machine by department and classification. Inasmuch as we use Hollerith tabulating machines for compiling factory information, we cannot use the combination of alphabet and numeral, but must use numerals only. Suppose we have a punch press numbered 140101. The first two digits show that the machine is in department No. 14, the next two digits indicate the classification (in this instance a No. 10 Bliss punch press) and the last two digits show that it is machine No. 1 in the classification. If a machine were numbered 140102 it would show that it is machine No. 2 in the same department and classification as the one above, while a machine marked No. 160103 would be the same kind of a press located in department No. 16 and being No. 3 of the series. The record also gives the average time required for performing each manufacturing operation on one hundred parts and this figure is corrected quarterly, using the efficiency record for the last quarter. When methods are changed the record is immediately changed without waiting for the quarterly period.

The record is kept up-to-date by the record section



RECORD OF EMPLOYEE'S EFFICIENCY ON WORK COMPLETED
CORONA TYPEWRITER COMPANY, INC.

Date 8-29-1920

Dept. No. 2

	[illegible]	[illegible]	[illegible]	[illegible]	OPERATION NAME	[illegible]	METHOD OF WAGE PAYMENT	REASON FOR DAY WORK OR EXTREME EFFICIENCY	[illegible]	[illegible]	[illegible]	REJECTIONS QTY	REASON	QTY.	REASON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	57	Baird	221	4	Profile Top	6844	✓		979	1.32	12.61						979	102		12.92

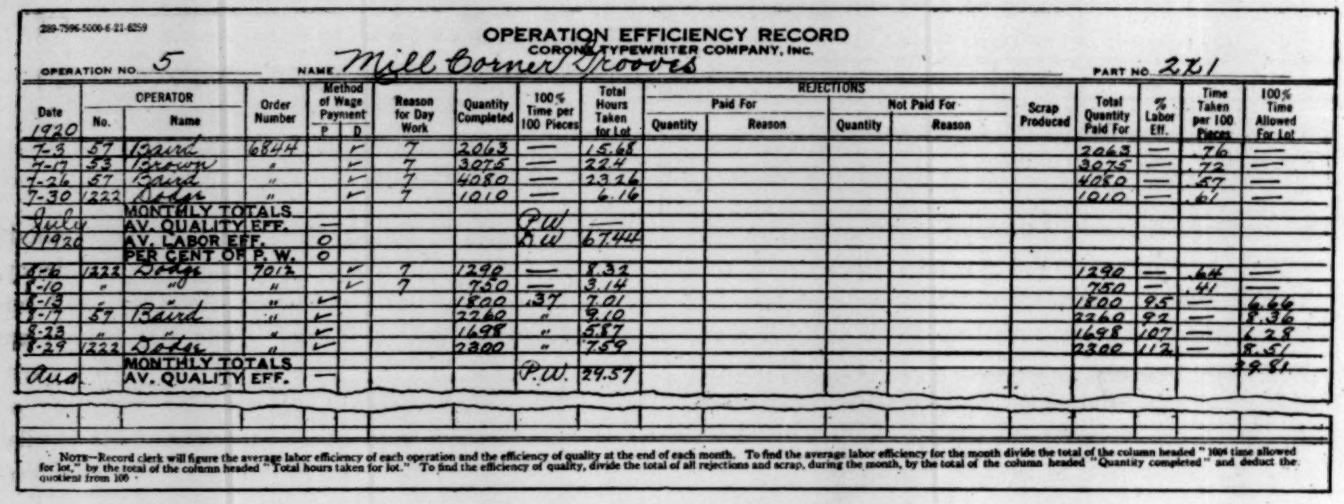
Fig. 8. Record of Employee's Efficiency on Work Completed.

of the methods division, although used primarily by the control board section in planning their work on the control board. The information is essential to the control board section, both because it gives operation time and because it enables it to allocate work to machine groups and thus equalize the production demand on all machines in the group.

(c) Research to Secure Standards

Time Study, Instruction Cards and Performance Records. Before any work can be done by the instruction card section of the methods division a routine instruction card must be made out for the part that is to be studied and standardized. This is done from information received from the experimental and designing department and the production equipment engineering department. The card has been described elsewhere. The methods section then furnishes the instruction card section with all of the necessary data as to the proper methods of manufacture to be followed, and with this information available they proceed to make the time study observation. For this purpose a time study observation sheet is used (Fig. 5). After the time study man has determined the rate which he feels is satisfactory and up to standard, he presents his conclusion and supporting data on the proposal sheet. This sheet gives all of the information necessary to enable the head of the planning department and the works manager to pass on the proposed rate, and upon their approval the instruction card, showing the method of operation, is issued (Figs. 6 and 7). The standard having been set and the operator having been instructed to perform the work according to the instruction card, and the piece rate being established by the issuing of the card with the work, the operator is rung in on an operation cost ticket and completes the lot assigned to him. Upon completion of the work the operation cost ticket accompanies the work to the planning center, the time is recorded, inspection made and rejections recorded and the planning center clerk posts the accomplishment on the record of the employee's efficiency on work completed (Fig. 8). This record is made out in duplicate, one copy being sent to the department supervisor to be posted in the department if desired, and the other is sent to the record section of the methods division. From the record of employee's efficiency, the record section posts operation efficiency, and operators efficiency records (Figs. 9 and 10), which are always available for the purpose of comparing earnings of individuals, relative efficiency of operators on the same operation, and other information of similar nature. Probably the greatest value of the two records is in furnishing information to the methods division as to the relation of accomplishment to theoretical standards.

It sometimes happens that piece work operations have to be run day work because, although the operation ticket is stamped "Piece Work," the supervisor finds that he cannot, in fairness to the operator, run on piece work. This may be occasioned by the fact that an operator is a learner; that the wrong class of labor is employed, as for example, a man on a woman's job; that piece work has been temporarily suspended because of changes in previous operations or part design; or some other cause of a like nature. In such cases, change to day work is made on approval of the works manager. Occasionally in order to secure balance of production, we are obliged to transfer a man from one operation or job to another. In such cases, where there is sufficient work ahead of the man on his regular job and he is transferred because of his special knowledge of another job, but may not be a high efficiency man on that job because of lack of recent practice, we provide a special method of compensation so that he will not be penalized for his greater value to the company. It may also happen that changes in design cause the temporary suspension of piece rates through no fault of the operator and we feel that he or she should be compensated fairly during the time that the job is under time study observation for change. In all of these cases the supervisor requests a special hourly rate for the operator and, if granted by the works manager, a special hourly rate card is made out on which a rate is given based on the last four weeks average piece work earnings of the operator. This card is in two parts, is sent to the works manager for approval, then the upper part is sent to the cost department and the lower part to the depart-



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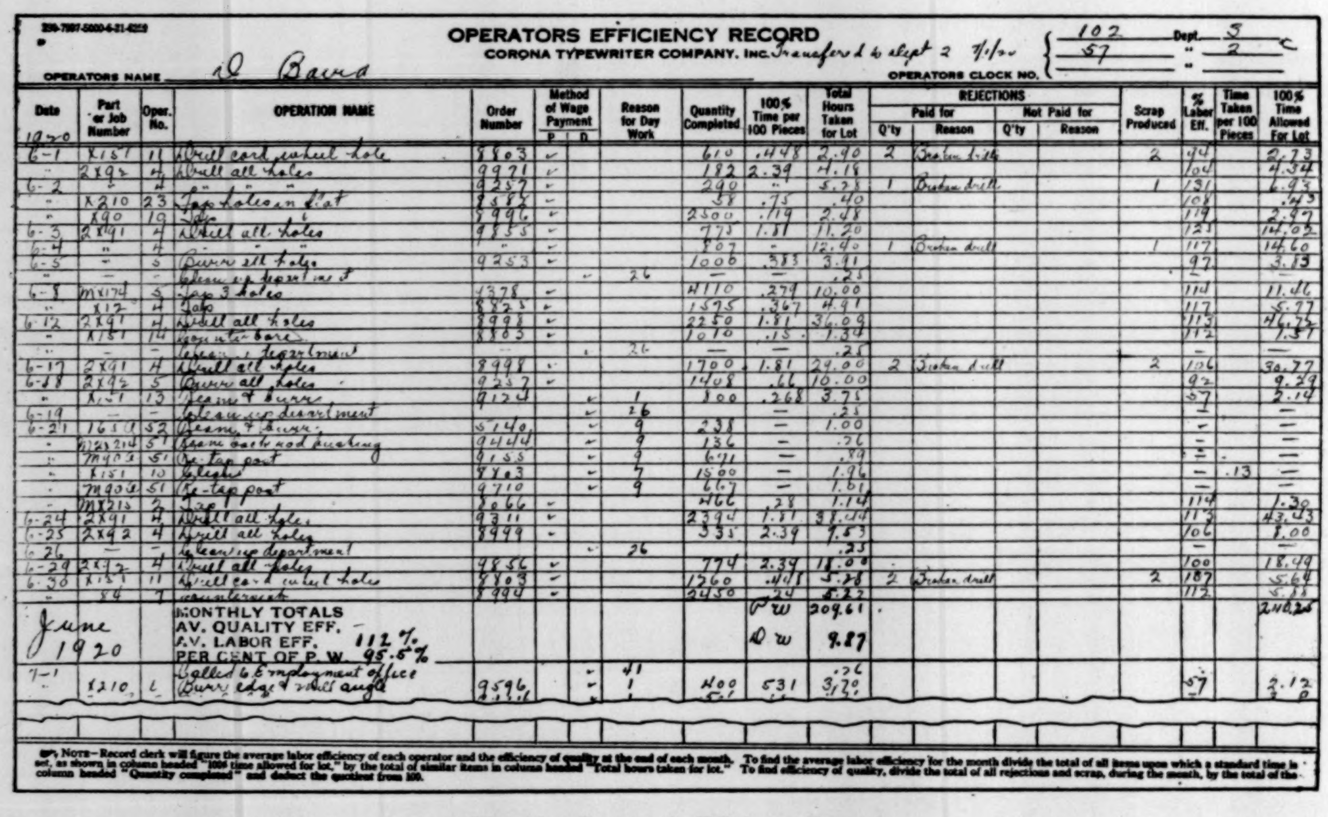
OPERATION EFFICIENCY RECORD
CORONA TYPEWRITER COMPANY, INC.

OPERATION NO. 5 NAME Mill Corner Grooves PART NO. 2X1

Date 1920	Operator No.	Operator Name	Order Number	Method of Wage Payment P	D	Reason for Day Work	Quantity Completed	100% Time per 100 Pieces	Total Hours Taken for Lot	Rejections Paid For Quantity	Reason	Not Paid For Quantity	Reason	Scrap Produced	Total Quantity Paid For	% Labor Eff.	Time Taken per 100 Pieces	100% Time Allowed For Lot
7-3	57	Baird	6844		✓	7	2063	—	15.68						2063	—	.76	—
7-17	53	Brown	"		✓	7	3075	—	22.4						3075	—	.72	—
7-26	57	Baird	"		✓	7	4080	—	23.26						4080	—	.57	—
7-30	1222	Dodge	"		✓	7	1010	—	6.16						1010	—	.61	—
July		MONTHLY TOTALS																
		AV. QUALITY EFF.		—				P.W	—									
1920		AV. LABOR EFF.		0				D.W	67.44									
		PER CENT OF P. W.		0														
8-6	1222	Dodge	7012		✓	7	1290	—	8.32						1290	—	.64	—
8-10	"	"	"		✓	7	750	—	3.14						750	—	.41	—
8-13	"	"	"	✓			1800	.37	7.01						1800	95	—	6.66
8-17	57	Baird	"	✓			2260	"	9.10						2260	92	—	8.36
8-23	"	"	"	✓			1698	"	5.87						1698	107	—	6.28
8-29	1222	Dodge	"	✓			2300	"	7.59						2300	112	—	8.51
		MONTHLY TOTALS																29.81
Aug		AV. QUALITY EFF.		—				P.W.	29.57									

NOTE—Record clerk will figure the average labor efficiency of each operation and the efficiency of quality at the end of each month. To find the average labor efficiency for the month divide the total of the column headed "100% time allowed for lot," by the total of the column headed "Total hours taken for lot." To find the efficiency of quality, divide the total of all rejections and scrap, during the month, by the total of the column headed "Quantity completed" and deduct the quotient from 100.

Fig. 9. Operation Efficiency Record.



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OPERATORS EFFICIENCY RECORD
CORONA TYPEWRITER COMPANY, INC. Transferred to dept 2 7/1/20

OPERATORS NAME D Baird

OPERATORS CLOCK NO. 102 Dept. 3
57 " 2

Date 1920	Part or Job Number	Oper. No.	Operation Name	Order Number	Method of Wage Payment P	D	Reason for Day Work	Quantity Completed	100% Time per 100 Pieces	Total Hours Taken for Lot	Rejections Paid for Q'ty	Reason	Not Paid for Q'ty	Reason	Scrap Produced	% Labor Eff.	Time Taken per 100 Pieces	100% Time Allowed For Lot
6-1	X151	11	Drill card wheel hole	8803	✓			610	.448	2.90	2	Broken drills			2	94		2.73
"	2X92	4	Drill all holes	9971	✓			182	2.39	4.18						104		4.34
6-2	"	4	" " "	9257	✓			290	"	5.28	1	Broken drill			1	131		6.93
"	X210	23	Tap holes in flat	8582	✓			58	.75	.40						108		.43
"	X90	19	Tap	8996	✓			2500	.119	2.48						119		2.97
6-3	2X91	4	Drill all holes	9855	✓			773	1.81	11.20						123		14.02
6-4	"	4	" " "	"	✓			807	"	12.40	1	Broken drill			1	117		14.60
6-5	"	5	Burr all holes	9253	✓			1006	.383	3.91						97		3.85
"	—	—	Clean up department			✓	26	—	—	.25						—		—
6-8	MX174	5	Tap 3 holes	4378	✓			4110	.279	10.00						114		11.46
"	X12	4	Tap	8823	✓			1575	.367	4.91						117		5.77
6-12	2X91	4	Drill all holes	8998	✓			2250	1.81	36.09						113		40.72
"	X151	14	Counter-bore	8803	✓			1010	.15	1.34						112		1.51
"	—	—	Clean up department	—		✓	26	—	—	.25						—		—
6-17	2X91	4	Drill all holes	8998	✓			1700	1.81	29.00	2	Broken drill			2	106		30.77
6-18	2X92	5	Burr all holes	9257	✓			1408	.66	10.00						92		9.29
"	X151	13	Ream & burr	9124		✓	1	800	.268	3.75						57		2.14
6-19	—	—	Clean up department			✓	26		—	.25						—		—
6-21	1650	52	Ream & burr	5140		✓	9	238	—	1.00						—		—
"	MX2214	51	Ream back rod bushing	9444		✓	9	136	—	.76						—		—
"	MX903	51	Re-tap post	9155		✓	9	691	—	.89						—		—
"	X151	10	[illegible]	8803		✓	7	1500	—	1.96						—	.13	—
"	MX903	51	Re-tap post	9710		✓	9	667	—	1.61						—		—
"	MX215	2	Tap	8066	✓			466	.28	1.14						114		1.30
6-24	2X91	4	Drill all holes	9311	✓			2394	1.81	38.44						113		43.33
6-25	2X92	4	Drill all holes	8999	✓			335	2.39	7.53						106		8.00
6-26	—	—	Clean up department			✓	26			.25						—		—
6-29	2X92	4	Drill all holes	9856	✓			774	2.39	18.00						100		18.49
6-30	X151	11	Drill card wheel hole	8803	✓			1260	.448	5.28	2	Broken drill			2	107		5.64
"	84	7	countersink	8994	✓			2450	.24	5.22						112		5.88
June			MONTHLY TOTALS						P W	209.61								240.26
			AV. QUALITY EFF. —															
			AV. LABOR EFF. 112%						D W	9.87								
1920			PER CENT OF P. W. 95.5%															
7-1			Called to Employment office			✓	41			.26								
"	X210	6	Burr edge & mill angle	9596		✓	1	400	531	3.70						57		2.12

NOTE—Record clerk will figure the average labor efficiency of each operator and the efficiency of quality at the end of each month. To find the average labor efficiency for the month divide the total of all items upon which a standard time is set, as shown in column headed "100% time allowed for lot," by the total of similar items in column headed "Total hours taken for lot." To find efficiency of quality, divide the total of all rejections and scrap, during the month, by the total of the column headed "Quantity completed" and deduct the quotient from 100.

Fig. 10. Operator's Efficiency Record.

ment supervisor who turns it over to the planning center clerk. It then becomes the duty of the planning center clerk to see that all time tickets of the operator, for the work and during the time authorized on the special hourly rate card, are stamped "Special Hourly Rate No. ———," giving the number of the card.

The company has an established policy that no piece rates may be changed unless they are set too low, in which case they will be adjusted upward to what is considered standard; or in cases where radical changes have been made in the method of performing an operation and the operations are directly affected or where previous operations have been changed or parts redesigned. This is a precaution against the lowering of rates because they may have been loosely set. In order that operators may be fully cognizant of this rule we have placed on every instruction card holder a slip stating our piece work policy.

Experimental Work—Factory. All factory experimental work is under the direction and control of the methods section of the methods division of the planning department, and it is their duty to devise and maintain the best methods of manufacture and procedure that can be developed or found. They accomplish this through original research work on parts, processes, materials, supplies, equipment, etc.; careful reading of technical papers and books; visits to other factories; the investigation of complaints of difficulties encountered; the maintenance of written standard practice instructions for the methods adopted, and constant contact with the results obtained from these adopted methods: through records of accomplishment; and then more detailed investigation to secure even greater benefits.

For convenience in operation, methods work is divided into three groups, each group being under an engineer who is familiar with the particular requirements of the work in his section, and with the general policies of the company in relation to such work.

This grouping is as follows:

1. General machining of parts and their inspection.
2. General metal finishing, hardening, cleaning, chemical investigation and analysis and the inspection necessary.
3. All sub-assemblies and machine assemblies and their inspection.

The engineer at the head of a group is responsible for all methods adopted as standard in that group. He is expected to keep the work at the highest possible point of efficiency in all ways, and is responsible for the technical accuracy and completeness of the methods and processes adopted. Through this grouping and defined responsibility are found the best machines for the work; the shortest and most economical path of work; the inspection that is necessary and at what point and by whom it shall be given; the easiest and most economical method of performing the work; the operations best adapted to the work; the location of machines and work for the best results; the effect of changes in design and in tools on standard methods; the value of recommendations from operators and supervisors as to betterments; the proper small tools to use; the most economical use of supplies; the correction of troubles, etc.

In the methods section is placed the responsibility for initiating improvements and general betterments and the following up of these ideas to the point of acceptance or rejection; and the responsibility for seeing that standard practice instructions for all work are issued, and that the results obtained from these standard methods are satisfactory in all ways.

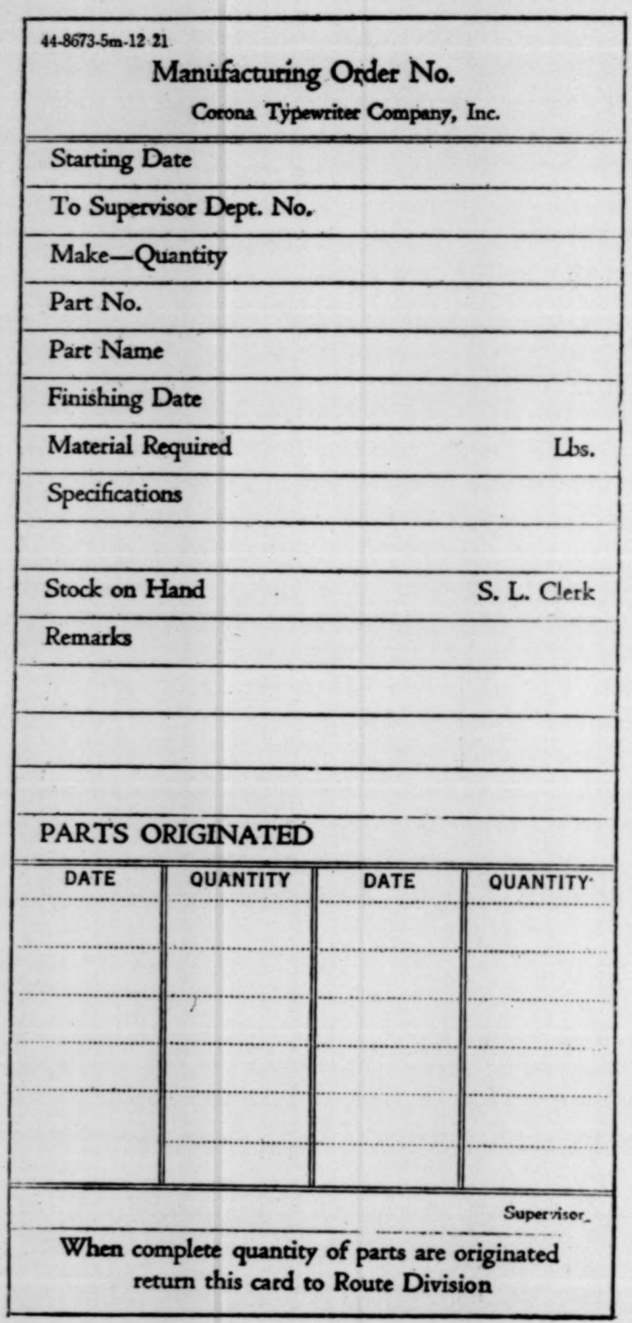
If the methods section were operating at full theoretical efficiency it would investigate and find the best obtainable methods for securing the greatest prosperity for both company and employees; would see that the interests of both employer and employees are identical; demonstrate that by economy and the elimination of waste in materials, time and effort, a high wage can be maintained and a low production cost secured; would see that there are no wasted motions or movements—not one useless or unnecessary job performed; that there is absolutely accurate control of every operation, function and department in accordance with the best knowledge obtainable as to what is most desirable; that this knowledge is recorded and becomes a standard until some better knowledge supplants it; that this knowledge and standard is constantly utilized and applied; that proper use and application of this knowledge is fitly rewarded; and to make repeated studies and investigations of any data or information that can be used to further these objects.

(d) The Planning Department

Scheduling, Routing, Controlling and Dispatching.

Parts Ledger. A record of all parts is kept in what is known as the parts ledger. This ledger records all parts on order, in process and in finished parts. Each part has a sheet in the ledger and in the upper right-hand corner is shown the number of parts per set and the lot size to be ordered. In the upper left-hand corner we show the lead. This lead is determined by first figuring the number of days it takes to manufacture an order of parts. The number of days multiplied by the production per day (this data being furnished by the works manager for as many months in advance as possible) plus the minimum amount for finished parts stock gives the lead, or the minimum number of parts that should be available and on order. When the quantity shown in the "Available and Ordered" column is within ten days of the minimum, the stock ledger clerk immediately issues a manufacturing order for the quantity of parts specified in the upper right-hand corner.

Manufacturing Order. The manufacturing order is filled in showing starting date, and finishing date (Fig. 11). The starting date is determined from the parts ledger lead and the finishing date by adding the number of days it requires to manufacture the given quantity to the date on which the order is to start. The manu-



44-8673-5m-12-21

Manufacturing Order No.

Corona Typewriter Company, Inc.

Starting Date

To Supervisor Dept. No.

Make—Quantity

Part No.

Part Name

Finishing Date

Material Required Lbs.

Specifications

Stock on Hand S. L. Clerk

Remarks

PARTS ORIGINATED

DATE	QUANTITY	DATE	QUANTITY

Supervisor

When complete quantity of parts are originated return this card to Route Division

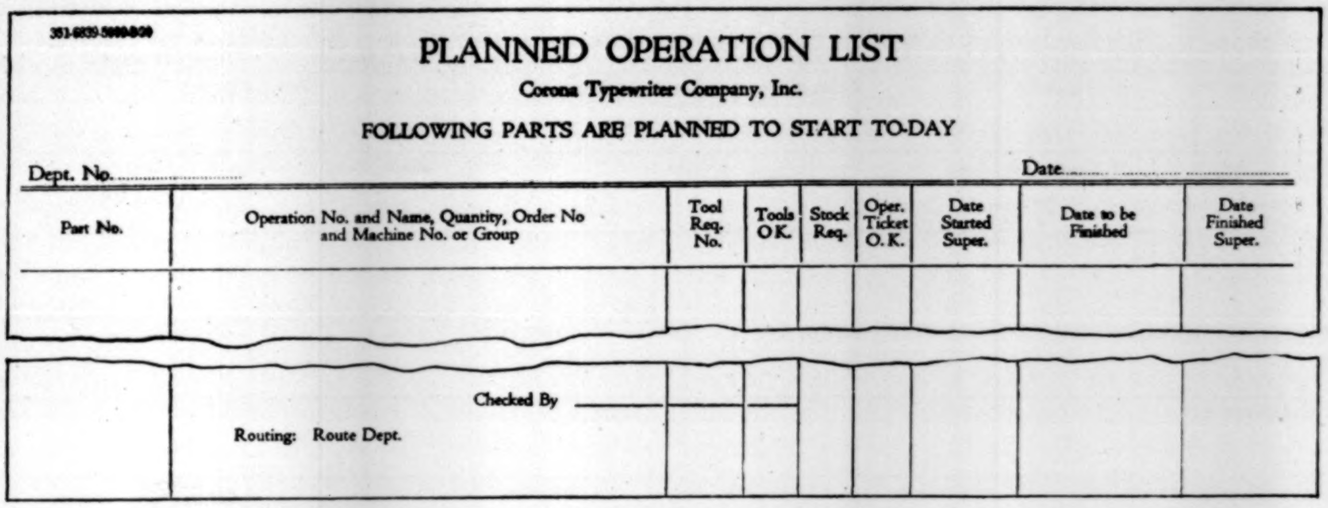
Fig. 11. Manufacturing Order.

facturing order is then sent to the balance of stores ledger clerk who apportions the material on the balance of stores card and then sends the order to the control board division for use in planning on the control boards. If for any reason the balance of stores clerk does not have the material required, the order is returned to the parts ledger clerk where it is filed under "Orders Held up for Material," and the balance of stores clerk immediately takes the matter up with the purchasing department in order to hasten delivery of material.

Control Board. The control board clerk upon receiving the manufacturing order immediately checks up all tools and machines required for the manufacture of the order to prevent hold-ups, or in other words, he does the same as a train dispatcher—sees that his tracks are clear for the coming train. After he has satisfied himself that tools and machines are available for the routing of work on the control boards, he takes the machine burden record and proceeds to lay out his work on the control boards so that it will be completed on the finishing date specified on the manufacturing order.

Each control board consists of a number of grooves, every groove representing a part. When necessary several grooves are used for the one part. At the top of the board is a calendar of all working days, each day represented by an index strip 1 4/5 in. long for each day from Monday to Friday inclusive, and 1 in. long for Saturdays. The reason for this is that 1/5 of an inch represents one hour and we work nine hours each day from Monday to Friday inclusive, and five hours on Saturday. Long white cardboard strips 3/4 in. high are printed with markings every 1/5 of an inch, each mark representing an hour and every fifth mark is a heavy line for quick reference. If the first operation taken from the routine card for the given order of parts should take twelve hours, one of these strips is cut 2-2/5 in. long, and the following information is placed thereon: Part Number, order number, operation number, machine number, quantity and department number. This slip is then placed on the board in the groove representing the part and under the date which the machine burden record shows that the machine will be available. While it is true that we plan to a certain machine, the supervisor of a department may do the work on any machine in the group, but he must complete the work in the specified time. The control board clerk proceeds in the same manner with all operations on the order until all have been posted.

Planned Operation Lists. The dispatch clerk copies all work shown on the control board on what is known as the planned operations lists (Fig. 12). This list is sent to the department supervisor six days in advance of the time that an operation is to be started to show him just what work he will have to do in his department. These planned operation lists are made out in triplicate, one copy being sent to the supervisor of the department, one to the planning center serving that department, and one being filed for reference of the dispatch clerk. The planned operation lists give the part number, operation number and name, quantity, order



[illegible]

PLANNED OPERATION LIST

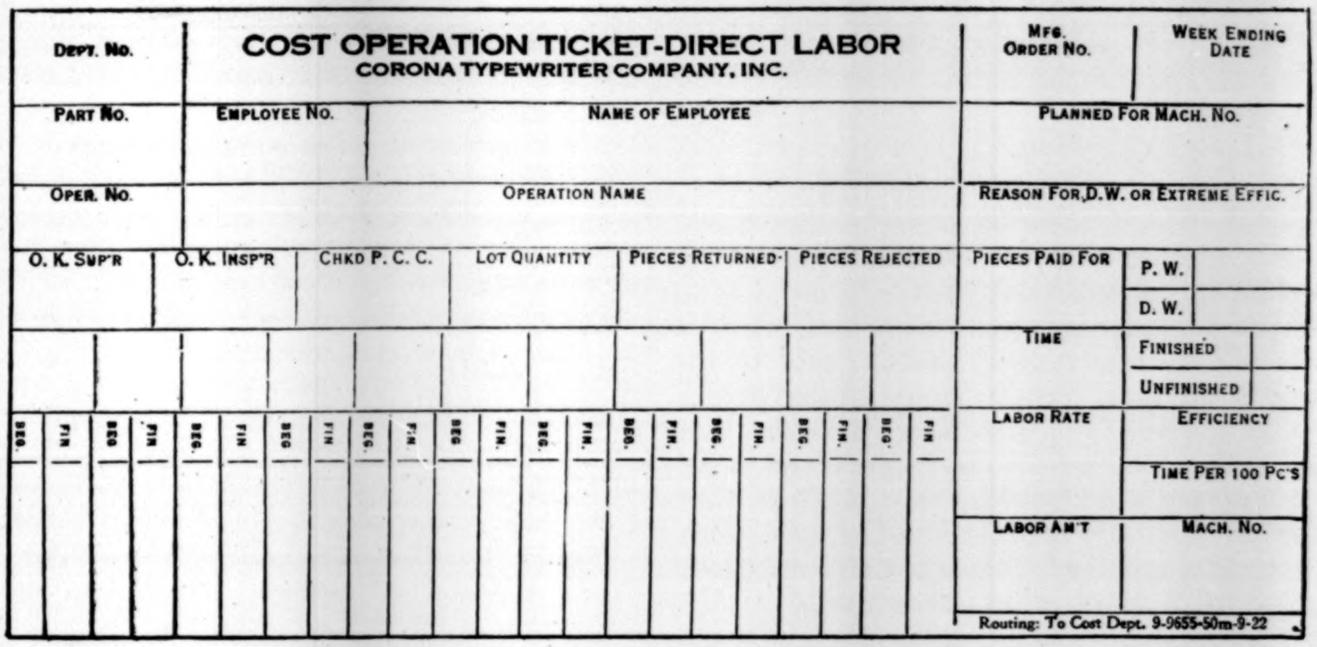
Corona Typewriter Company, Inc.

FOLLOWING PARTS ARE PLANNED TO START TO-DAY

Dept. No. .... Date.............................

Part No.	Operation No. and Name, Quantity, Order No and Machine No. or Group	Tool Req. No.	Tools O.K.	Stock Req.	Oper. Ticket O.K.	Date Started Super.	Date to be Finished	Date Finished Super.
	Checked By ________ Routing: Route Dept.							

Fig. 12. Planned Operation List.



Dept. No.	COST OPERATION TICKET-DIRECT LABOR CORONA TYPEWRITER COMPANY, INC.	Mfg. Order No. | Week Ending Date
Part No.	Employee No. | Name of Employee	Planned For Mach. No.
Oper. No.	Operation Name	Reason For D.W. or Extreme Effic.

O. K. Sup'r	O. K. Insp'r	Chkd P. C. C.	Lot Quantity	Pieces Returned	Pieces Rejected	Pieces Paid For	P. W. D. W.

BEG.	FIN	BEG	FIN	BEG.	FIN	BEG	FIN	BEG.	FIN.	BEG	FIN.	BEG.	FIN.	BEG.	FIN.	BEG.	FIN.	BEG.	FIN.	BEG.	FIN

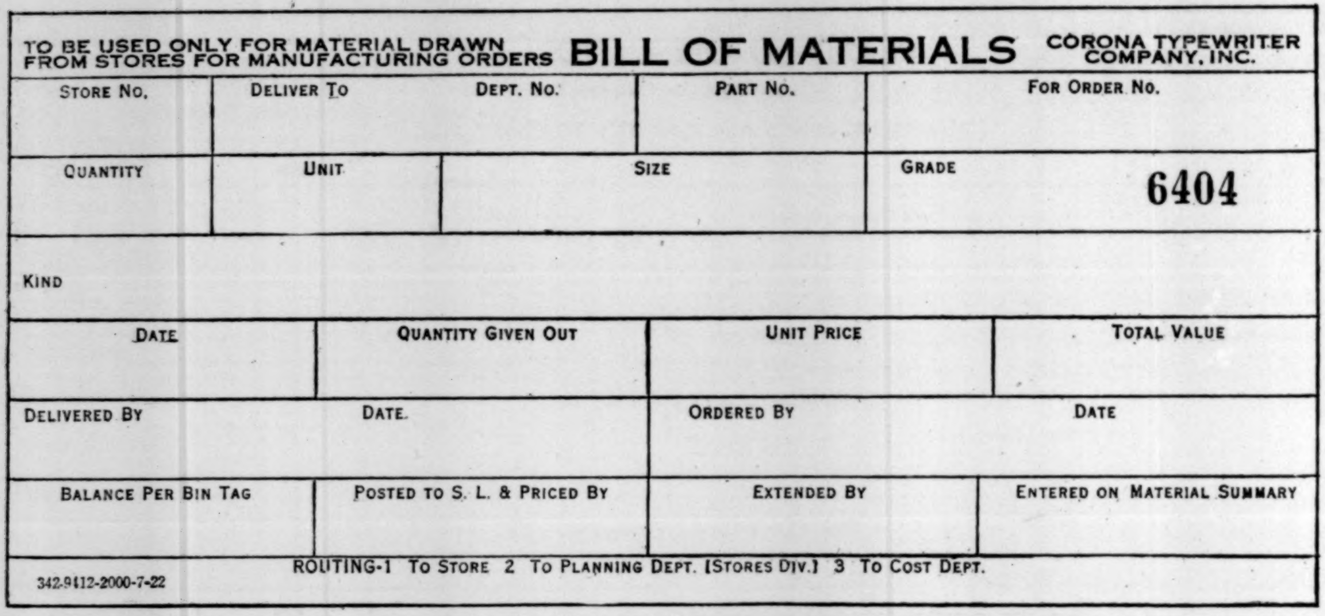
Time	Finished Unfinished	
Labor Rate	Efficiency Time Per 100 Pc's	
Labor Am't	Mach. No.	

Routing: To Cost Dept. 9-9655-50m-9-22

Fig. 13. Operation Cost Ticket.

number, machine number, or group, date to be started and date to be finished. The dispatch clerk also makes out all operation cost tickets (Fig. 13) covering planned work shown on the planned operation lists, and sends them with the planning center copy of the planned operation lists to the proper planning center clerk. He also sends the bills of materials (Fig. 14) for all materials to the raw material stores. The reason for sending the planning center clerk a copy of the planned operation list is to inform him of the work to be done in the department which he serves so that he may be ready to deliver it to the proper machine at the time specified. The supervisor of the department checks the planned operation lists as he completes the work, and upon completion of all work shown on any one planned operation list he returns the list to the dispatch clerk in the control board division where it is checked with the control boards to catch any error due to posting the control board or to the supervisor incorrectly checking his list.

Operation Cost Tickets. Operation cost tickets are made out in duplicate and are used to record time and other data for pay roll and costing purposes. Upon completion of an operation, all operation cost tickets are



TO BE USED ONLY FOR MATERIAL DRAWN FROM STORES FOR MANUFACTURING ORDERS **BILL OF MATERIALS** CORONA TYPEWRITER COMPANY, INC.

STORE NO.	DELIVER TO	DEPT. NO.	PART NO.	FOR ORDER NO.
QUANTITY	UNIT	SIZE	GRADE	6404

KIND

DATE	QUANTITY GIVEN OUT	UNIT PRICE	TOTAL VALUE
DELIVERED BY	DATE	ORDERED BY	DATE
BALANCE PER BIN TAG	POSTED TO S. L. & PRICED BY	EXTENDED BY	ENTERED ON MATERIAL SUMMARY

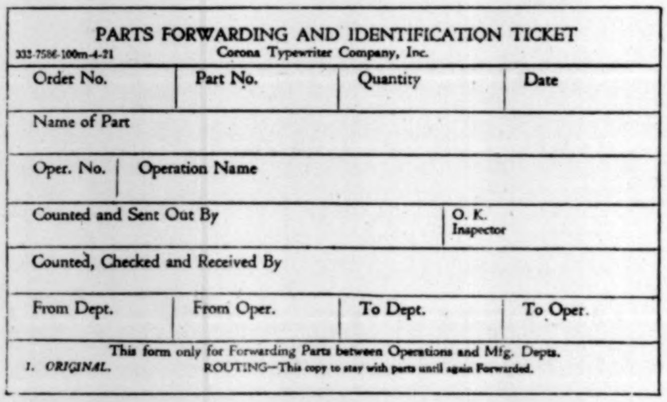
342-9412-2000-7-22 ROUTING-1 TO STORE 2 TO PLANNING DEPT. [STORES DIV.] 3 TO COST DEPT.

Fig. 14. Bill of Materials.

signed by the inspector and supervisor of the department doing the work. The inspector signs all tickets because nearly all of our work is piece work and we do not pay operators for work which they perform that is not up to standard quality. Tickets are signed by the supervisor of the department because he may find it necessary to change operations from piece work to day work. All such changes, however, must be approved by the works manager or his assistant before day work will be paid for piece work operations. The original copy of the operation cost ticket is sent to the pay roll division of the cost department, and from there to the cost clerk. The duplicate is sent to the dispatch clerk in the control board division and all work shown as completed is posted on the control boards.

Bill of Materials. The bill of materials is made out in duplicate and is sent to the raw material stores by the dispatch clerk. The stores keeper issues the material to the department indicated and at the time specified, and then sends the bill of materials to the balance of stores clerk where it is entered on the balance of stores ledger, priced and extended, and forwarded to the cost department.

Parts Forwarding and Identification Ticket. All parts are forwarded from one operation to another on parts forwarding and identification tickets (Fig. 15). Every pan of work must have one of these tickets and they must be O.K.'d by the inspector before the parts may be physically moved from a planning center. A copy of the parts forwarding and identification ticket is sent to the scheduling division of the planning department where it is filed for reference. When a manufacturing order is issued an entry is made in the parts ledger under "On Order" column. When a parts forwarding and identification ticket covers parts being forwarded from material to the first manufacturing operation, an entry is made in the parts ledger, transferring parts from the "On Order" to "In Process" column. Where parts are forwarded from the last operation to finished parts stock, we use a parts forwarding and identification ticket of a different color to facilitate sorting. All parts forwarding and identification tickets that accompany parts to finished parts stock are posted in the parts ledger and the parts are transferred from the "In Process" to the "Finished Parts" column.



PARTS FORWARDING AND IDENTIFICATION TICKET
332-7586-100m-4-21 Corona Typewriter Company, Inc.

Order No.	Part No.	Quantity	Date

Name of Part

Oper. No. | Operation Name

Counted and Sent Out By | O. K. Inspector

Counted, Checked and Received By

From Dept.	From Oper.	To Dept.	To Oper.

This form only for Forwarding Parts between Operations and Mfg. Depts.
1. ORIGINAL. ROUTING—This copy to stay with parts until again Forwarded.

Fig. 15. Parts Forwarding and Identification Ticket.

Requisitions for parts. All requisitions for parts from finished parts stock are sent to the Parts Ledger Clerk and are posted in the parts ledger, deducting the quantity from the "Finished Parts" and the "Available and On Order" columns.

Assembling Operations. As previously stated assembling operations are begun in our Cortland plant. The first step in assembling is known as sub-assembling. Here we have parts requisitioned to jobs from the finished parts stock room and delivered to the jobs in standardized trays to increase operator efficiency. All operations are on piece work and highly standardized tools and fixtures are used. When the sub-assemblies are completed they are sent to the assembly stock service division where they are placed in trays with other parts and are issued to the various jobs on which they are used.

Major assembly operations begin with the numbering of the frame, all frames being numbered serially. Assembly work is progressive, there being a certain number of girls or men performing the same work on a job. When a frame is numbered it is placed on a rack on the front of the work bench within easy reach of the operator and upon completion of the next operation it is placed on the next bench and so travels from one end of the room to the other so that there is a continuous flow until assembly work is completed. Up to the time a machine reaches what is known as the key board operation all machines are identical. Starting with the key board operation, however, the identity of machines is established through the stamping of the assembly card, which I describe later. The card is stamped to show whether it is a No. 20 key board, which would be a regular American key board, a No. 28, which would be English, etc. At the same time it is stamped to show whether it is a Pica, Elite, Medium Roman, etc., type, and whether it has Gothic or plain figures. When this information has been stamped on the card, the corresponding key board is assembled and corresponding type are soldered on after the key board assembly, and when the machine reaches the part final assembly, a carriage with Elite spacing or Pica spacing, as the case may be, is assembled to the machine.

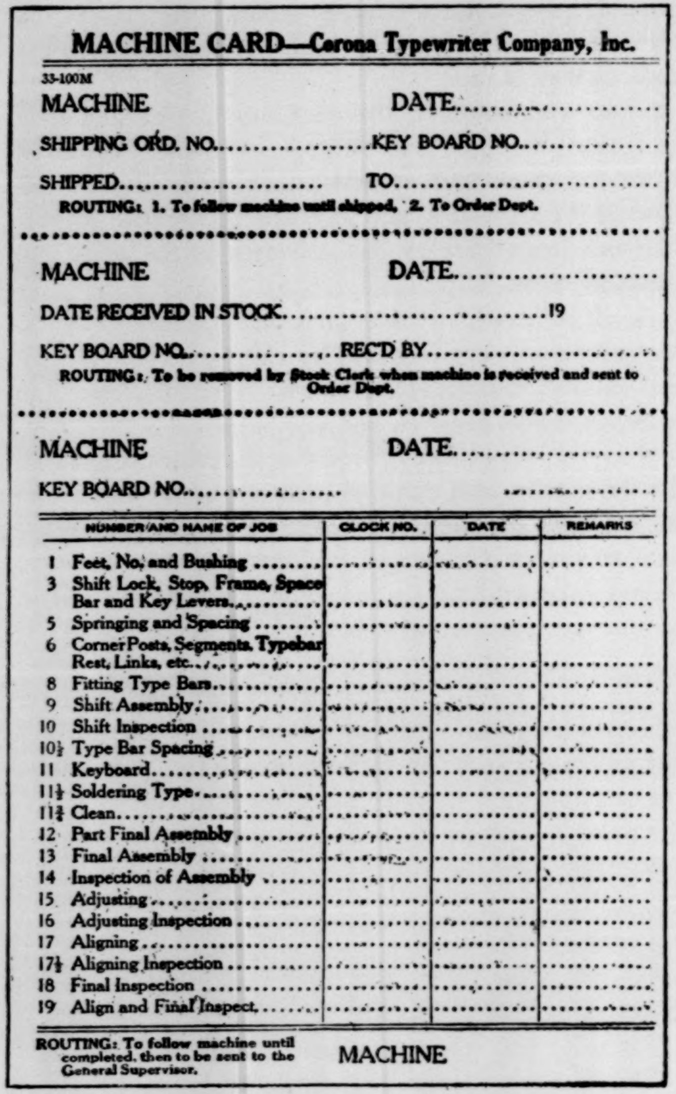
The information which enables the key board job to stamp the assembly cards is received from the planning department each week. They in turn depend on the order department of the general administrative organization for the figures showing the kinds and quantities of each keyboard that are to be manufactured. The order department, of course, knows the production planned for the month, and they simply apportion orders on that basis.

Upon completion of the machines in Cortland they are placed in cases and shipped to Groton, removed from the cases and adjusted, inspected, aligned, inspected for alignment, and then sent to the final inspection and from there by belt conveyor to the stock and shipping room.

Assembly Card. Unlike parts manufacturing the operator's time is not recorded by ringing an operator in and out on a cost ticket, instead we have substituted the assembly card (Figs. 16 and 17), which is a card doubled over with perforated strips on the under part, bearing the number and name of each job, serial number of the machine, which the card accompanies, and place for date and clock number of the operator. As the card travels forward with the machine, the stub is filled in by the operator for the job which he performs and is torn off and retained until the end of the day when all stubs are turned into the department clerk and are carefully checked. The clerk then makes out an output report for each job and also makes out time tickets for each operator, entering the number of assemblies on the ticket corresponding with the stubs turned in. All assembling jobs are on piece work. Job inspectors, though on day work, tear off and turn in the stubs in the same way.

On the front of the assembly card there are three strips, all bearing the machine number, the long one giving the key board information, the numbers and names of all jobs and providing space for the clock number of the operator, and the date. When an operator tears off and fills in a strip he also fills in his number and the date on the front of the card. After a machine has been completed on final inspection there are no strips left to be torn off on the under part of the card and all information has been filled in on the larger card on the upper section. This is then torn off, the sample of the machine's work made by the aligning inspector is attached and the card is finally filed in the works manager's office. Of the two remaining stubs of the card, one is forwarded to the order department when the machine reaches stock and the other remains with the machine until it has been shipped and is then sent to the order department.

All the stubs turned in by operators are sent to the planning department and are sorted and collected by machine number and if any are missing a prompt inquiry is made. This insures the clearing of all machines



MACHINE CARD—Corona Typewriter Company, Inc.

33-100M

MACHINE DATE........................
SHIPPING ORD. NO....................KEY BOARD NO....................
SHIPPED........................ TO................................
ROUTING: 1. To follow machine until shipped, 2. To Order Dept.

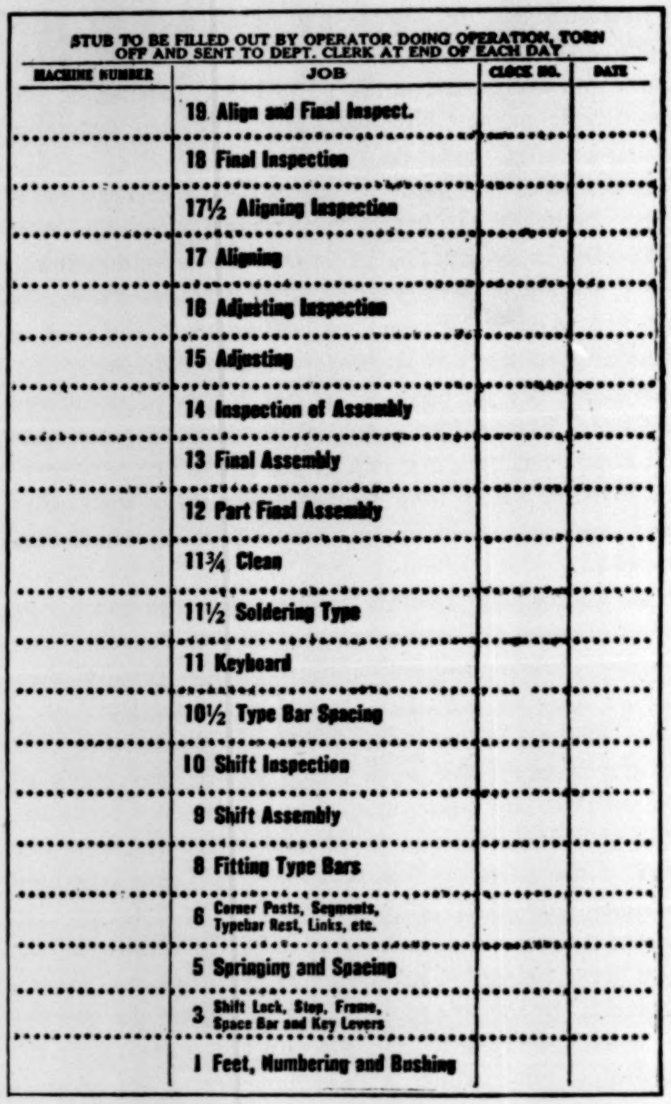
MACHINE DATE........................
DATE RECEIVED IN STOCK................................19
KEY BOARD NO..................RECD BY........................
ROUTING: To be removed by Stock Clerk when machine is received and sent to Order Dept.

MACHINE DATE........................
KEY BOARD NO.....................

NUMBER AND NAME OF JOB	CLOCK NO.	DATE	REMARKS
1 Feet, No. and Bushing			
3 Shift Lock, Stop, Frame, Space Bar and Key Levers			
5 Springing and Spacing			
6 Corner Posts, Segments, Typebar Rest, Links, etc.			
8 Fitting Type Bars			
9 Shift Assembly			
10 Shift Inspection			
10½ Type Bar Spacing			
11 Keyboard			
11½ Soldering Type			
11¾ Clean			
12 Part Final Assembly			
13 Final Assembly			
14 Inspection of Assembly			
15 Adjusting			
16 Adjusting Inspection			
17 Aligning			
17½ Aligning Inspection			
18 Final Inspection			
19 Align and Final Inspect.			

ROUTING: To follow machine until completed, then to be sent to the General Supervisor. MACHINE

Fig. 16. Assembly Card—Parts to Follow Machine.



STUB TO BE FILLED OUT BY OPERATOR DOING OPERATION, TORN OFF AND SENT TO DEPT. CLERK AT END OF EACH DAY

MACHINE NUMBER	JOB	CLOCK NO.	DATE
	19 Align and Final Inspect.		
	18 Final Inspection		
	17½ Aligning Inspection		
	17 Aligning		
	16 Adjusting Inspection		
	15 Adjusting		
	14 Inspection of Assembly		
	13 Final Assembly		
	12 Part Final Assembly		
	11¾ Clean		
	11½ Soldering Type		
	11 Keyboard		
	10½ Type Bar Spacing		
	10 Shift Inspection		
	9 Shift Assembly		
	8 Fitting Type Bars		
	6 Corner Posts, Segments, Typebar Rest, Links, etc.		
	5 Springing and Spacing		
	3 Shift Lock, Stop, Frame, Space Bar and Key Levers		
	1 Feet, Numbering and Bushing		

Fig. 17. Assembly Card—Stubs to be Filled Out by Operator.

and prevents the holding up of machines with old serial numbers. Special machines and rush orders are handled through assembling by affixing a small red rush tag to the assembly card. The assembly card is of a special size so that it will slip under the type basket of the machine without folding and this guards against the separation of the card from the machine and prevents confusion.

The large front portion of the card is retained and filed in the works manager's office for not less than one year to furnish information when required. For example, should one of our agents complain of the condition of a machine when received, he will send in the serial number and we will go to the file, take out the assembly card, examine the alignment record and take up the matter with the individual final inspector, aligner, adjuster or assembler through his supervisor. Furthermore, as a check on quality we receive from our largest offices each month a sample sheet for every machine that they have received during the month with any defects in parts, finish, adjustment or alignment noted on the sheet. Of course, the machine number is given on each sheet. The number of sheets received represents on an average 15 per cent of all machines shipped during the month. Upon receipt of these slips the number of the final inspector is secured from the assembly card and placed on the sheet. Then a complete recapitulation of complaints is made by kind and against the name of each final inspector, and the quality standard of the inspectors is determined by this. The record is posted in the final inspection department monthly, and also from this record our statistical department prepares monthly graphs for the works manager's office. Daily records showing the individual attainment of all operators on adjusting, aligning and final inspection and of all assembly jobs are sent to the works manager and cost department. These records show the daily production, production for the week, and for the month, and the number of machines available ahead of each job. The cost department prepares a department output report, showing the number of machines ahead, completed for the day, week, and month for each assembling unit, together with quantity shipped and orders received. Therefore every executive of the company knows daily the exact status of orders, shipments and production accomplishment. From this data the string board graphics in the works manager's office are posted daily, and a close control of assembly operations can thus be maintained.

Control of Materials. Materials are requisitioned only by the stores division of the planning department. Specifications for materials for parts designed by the designing and experimental department are furnished to the stores division and purchasing department by the methods division of the planning department. The balance of stores ledger cards used for all materials are practically identical with the Taylor balance of stores card. When the balance of stores card shows that the ordering point has been reached a requisition is made on the purchasing department in the usual way, a copy being retained for follow up purposes. However, in order to keep raw material inventories down it is the custom of the balance of stores ledger clerk to check the condition of the stock on the finished parts and parts in process string boards where the graphic inventories are carried. If it appears to him that the supply of parts in process or in finished stock is such as to warrant it, he will specify a later date for delivery on the requisition than if he were merely ordering from the balance of stores card. In most instances the clerk consults the head of the route division before making his decision to put off the delivery date.

Upon receipt of the requisition the purchasing agent issues the purchase order. Copies of the purchase order are sent to the receiving department and stores division and one is filed by the purchasing department. The stores division, upon receipt of the purchase order, makes the proper entries on the stores ledger card and from then on follows up the order on its copy of the original requisition. The purchasing department follows up the order on its copy of the purchase order. Upon receipt of the material the receiving department issues a material received report which is stamped "Inspect" if the material is to be inspected, or not stamped if inspection is not required. This report accompanies the material to the raw material inspection department and upon completion of inspection a copy of the report is sent to the stores division and a copy to the purchasing department and one accompanies the material to the store. Upon receipt of the material in the store room the quantity accepted is entered on a bin tag. The stores division makes the necessary entries from the receiving report on the stores ledger card and the purchasing department makes the entries on the purchase order, placing the order in the permanent file if it is complete.

When invoices are received all copies are sent to the purchasing department for checking the price and one copy is then sent to the stores division for recording of unit price, the other is sent to the accounting department for payment. In keeping our balance of stores ledger cards we use the average system of pricing.

When a manufacturing order showing the material required is originated by the route department it is sent to the stores division and they apportion the necessary material against the order and return the order to the route division O.K.'d to show that material is available.

Raw materials are issued on a bill of materials made out in the route division of the planning department and sent directly to the raw material stores. The raw material stores deliver the material to the proper department on the date specified and record the withdrawal on the bin tag and the bin tag balance on the bill of materials and then forward the bill of materials to the stores ledger clerk where the withdrawal entries are posted on the balance of stores ledger card, the unit price of the material entered on the bill of materials and extension made, the bin tag balance shown on the bill of materials compared with the ledger balance, and investigation and correcting entries made if necessary, and the bill of materials forwarded to the cost department. Perpetual inventory is maintained on all materials by checking the bin tag against an actual inventory of bin contents. The bin tag is then corrected if necessary and is sent to the stores ledger clerk to be checked against the stores ledger card. A correcting entry is made on the card if necessary. Bin tags are checked in such quantities as to insure complete inventory of all materials at least once a year.

The same procedure is followed on supply stores as on raw materials with the exception that no string board inventory is kept of regular supply stores and a supply requisition is substituted for the bill of materials.

(e) Economics Resulting From Precise Control.

It has been our experience that the thorough functionalizing of the factory organization and the resulting development of close control on all manufacturing activities has brought about many economies. The control of manufacturing operations through the study of proper routing and the elimination of all unnecessary operations has resulted in lower manufacturing costs. This has been very appreciably helped by the establishment of definite and precisely understood instructions for all operations, whether piece work or day work. We are not content with securing efficiency through piece work, but we have also established control of production on day work on both manufacturing operations and detail inspection operations. By maintaining accurate records we are able to compare individual efficiencies on the same operation or on similar operations, and gradually we are establishing dependable standards for operations not on piece work as well as for those on piece work. The direct saving in labor cost through the establishment of standards and the maintenance of records has been very high, resulting in lower costs for operations and higher returns to the operator.

Control of manufacturing operations through our planning system, and especially through the functioning of the route division, has enabled us to greatly reduce process and finished parts inventories. Our stores system has had the same effect on raw material inventories, and a close control of assembling operations through the daily posting of string boards in my office has enabled us to materially reduce assembly inventories by permitting us to operate on smaller cushions between jobs.

Possibly the best indication of the value of accurate production control mechanisms is our experience in the two years that we have operated our Cortland plant. We manufacture parts at Groton and we ship them each week day throughout the year by motor trucks to our Cortland plant, eleven miles from Groton, where we perform all sub-assembly operations and all major assembly operations on the machine. We also manufacture carrying cases. In the truck which carries over the parts we bring back the assembled machines in their cases ready for the operation known as adjusting. In winter we are obliged to keep the eleven miles of road open by means of a tractor operated snow plow. During the two years that we have operated in the face of blizzards and cloud bursts we have not had one hour's loss in production through failure of parts to reach the Cortland plant or the failure of the assembled machines to reach the Groton plant. Without precise control of all manufacturing functions such an accomplishment would have been impossible.

Furthermore, inasmuch as our plant operated eight years under the old line method of management and has now operated five years under the functional method of management, we have been able to definitely prove that what we have accomplished in the way of increased production and the avoidance of increased cost in the face of greatly increased wages, material costs and some expense items, could not have been accomplished under the old plan of control.

VI. RELATIONS WITH EMPLOYEES AND EMPLOYEE ACTIVITIES

During the thirteen years that the company has operated at Groton under the same management, unusual effort has been made to gain the confidence of all members of the organization in management policies. To be successful, therefore, it has been essential at all times that these policies be fundamentally sound and invariably fair. No effort has been spared to prevent the slightest semblance of paternalism from entering into relations between employees and the company. One of the rules, which has always been in force, is that any employee may interview the employment manager, or the works manager at any time on matters pertaining to wages, factory rules, or even purely personal matters, and he may also talk with the general manager or president of the company. The doors to all executive offices are open to employees, the only stipulation being that when the matter is to be taken up during regular working hours the employee shall arrange for an appointment through his supervisor. We extend this further than merely to the employee in that the same privilege is granted to a group of employees, or should the occasion arise, to an entire department. Where an employee or group of employees go to any executive's office for purposes such as outlined they are paid by the company the same as if they continued working in their department and the time so lost from production is recorded on an idle time ticket and the idle time expense is analyzed monthly by reasons.

I remember very distinctly a conference held some few years ago between the general manager and the new head of our employment department. The general manager, after carefully going over the situation with us, explained his attitude toward employees in this way:

"I want at all times a strictly fifty-fifty basis between the company and the employee, but occasions will arise where it may be difficult to make a decision on exactly that basis. In such cases you should favor the employee, not the company. In other words, where a strictly fifty-fifty decision cannot be made, the employee shall have all benefit of the doubt—shall have the larger end."

This instruction has been literally interpreted and carried out.

The problem of an industry in a small and somewhat isolated village is sometimes a difficult one inasmuch as the people are so largely dependent on themselves for recreation and amusement. We try to help in this as much as possible in the following ways:

Corona Band. This is an organization composed on an average of thirty-five skilled musicians employed by the company. The leader is a highly experienced musician and conductor. The band is uniformed and has weekly rehearsals every Tuesday for two hours at the company's expense and on company time. Men on hourly rates or piece work are paid for the rehearsal an amount equivalent to what their earnings would have been during that time had they worked in the factory on their regular jobs. Salaried employees are not paid for rehearsals. During the summer months the band gives weekly concerts out of doors and it is not uncommon for parties to come from quite distant points for these free concerts. In the winter free concerts are given monthly in the company gymnasium, followed by public dances to which a small admission is charged. The band also takes outside engagements for parades and concerts, and in such cases the members are not paid by the company, but the time lost from work is not marked against the employee. When playing for free concerts all members of the band are paid for each concert by the company.

Athletics. The company has provided a gymnasium for company activities only, and in the winter the company basketball five play with other industrial teams, at least one game a week at home and one away from home.

During the summer our baseball team plays all of its games on Saturday at Groton and Sunday games away from Groton. The company has provided an excellent baseball diamond with grand stand and bleachers; the former having a seating capacity of 350 and the latter of 1,100. In addition there is parking space for about thirty cars where games can be seen without leaving the cars.

Tennis courts are provided for employees and are maintained by the company.

All athletic activities are under the direction of an athletic director employed by the company for the sole purpose of handling such activities. It is a rule of the company that only regular employees shall be utilized in athletics conducted under the company name, except in cases where sickness, accident or some other abnormal factor makes a temporary substitution necessary. It is our desire to have only regular employees appear in the name of the company.

In addition to the activities described there are inter-department teams which arouse considerable interest, especially during the basketball season.

Club. At the present time restricted space limits club activities to the men, but it is planned that at sometime we shall have suitable quarters for men and women. All male employees of the company are eligible to club membership without the formality of a ballot, but they need not be members. Dues are twenty-five cents per month and club members elect their own officers and board of managers. The company supplies the rooms, heat and light, and the club from its dues purchases and maintains its pool and billiard tables, phonograph, reading material, furniture and equipment, and provides whatever forms of entertainment the house committee may decide upon. The club is entirely independent of the company in its operation although it has always been the practice of the members of the club (by far the greater majority of whom are in the factory) to elect to its board of managers two or three executives or department heads in addition to men from the factory.

Group Insurance. All employees in the company between sixteen and sixty years are automatically covered without examination; insurance becoming effective when an employee has been continuously in our employ for six months. The original amount of the insurance is five hundred dollars and the amount is increased annually by one hundred dollars for each year of uninterrupted service until the maximum of fifteen hundred dollars is reached. The entire expense of the insurance is carried by the company.

Medical Department. Our medical department is in charge of a graduate nurse, working under the direction of our factory physician. The department consists of a doctor's office, receiving room for patients, dispensary, nurse's office and the woman's rest room. The department administers first aid treatment and also gives professional advice in all cases of illness, and also dispenses medicine for factory and home use, no charge being made for any of the service or medicines. Detailed card records are kept of all patients calling at the department, and except in the case of emergency employees may go to the department only on passes issued by their supervisor or department head. From the time that an employee leaves his department to go to the medical department until his return he is carried on an idle time ticket and paid for the time lost. He is entitled to pay for that time.

The medical department is authorized to send any patient home because of an injury or illness and it is provided that no employee who has been sent home by the medical department may resume work until cleared through the medical department on a properly signed form. This is a protection to employees against infection during epidemic periods and it is our practice during such periods to send home any employee who may show conditions indicating that he may be contracting a contagious disease. Should an employee prefer to consult his own physician rather than our factory physician, he may do so, but will lose any time that he may be away from his job, and he must clear through the medical department before resuming work.

IN the *New Republic* of February 7 is an interesting article on the accumulation of capital in the United States during 1922, by David Friday, president of the Michigan Agricultural College, formerly professor of political economy at the University of Michigan and financial advisor to the Department of the Treasury.

He estimates the total of capital accumulation—excess of production over consumption—to be well over ten billion dollars.

While not giving exact figures, President Friday traces the sources of these savings as follows: something over 50 per cent by people of large means who own corporate and government securities, including officers who receive large salaries and are usually important stockholders; around 25 per cent by those who receive salaries and wages, whether from business enterprises or from governments; possibly 15 per cent by people engaged in the wholesale and retail trade; and approximately 10 per cent by farmers.

These savings are slightly less than one-sixth the total net income of the United States in 1922—an income somewhat over sixty billion dollars.

The saving of those receiving salaries and wages is an interesting item. In 1922 "the fear of depression and unemployment was still in the hearts of men, and the savings of this group expanded in an unusual manner. Probably at no time have the savings of the great mass of people in this country been larger than during the latter part of the year 1922. . . . Certainly the notion that a large distribution of the national income among the laboring classes militates against abundant capital accumulation finds little support in the events of the past year."

"Immediately, the funds thus saved were taken to the investment market, deposited in banks, paid to life insurance companies and building and loan associations, employed in the payment of debt, or used by the corporations or individuals who made them to employ labor and material for the construction of durable goods. Ultimately, they resulted in an addition to the nation's tangible wealth or to our claims against people abroad. The buildings which we have erected, the extensions which have been made to our public utilities and our railroads, the improvements in our highways and pavements, the betterments on our farms, the addition to our stock of durable goods like furniture and automobiles; these represent the capital which we have accumulated during the year. In addition we have imported several hundred million dollars of gold from abroad and have acquired half a billion of government securities. We have also sent some hundreds of millions as immigrant remittances and foreign relief to the needy of other nations."

"The sum of these stands as a striking achievement. It should silence most of the jingoist talk concerning the danger of foreign competition to this nation. No nation or group of nations can threaten seriously our economic supremacy. We are within striking distance of an economic order where the means of well-being shall be established for all."

REDUCTION OF WASTE IN OPERATING DEPARTMENTS OF LARGE RETAIL STORES[1]

By Philip J. Reilly[2]

In former meetings of the Taylor Society attention has been given to the results of certain investigations by management engineers, of waste in industry and the most effective methods that have been used in its reduction.

At the invitation of your Managing Director, this paper has been prepared to indicate the results of certain recent studies in waste reduction that were made by a number of representative department stores.

In a recent compilation of the operating expenses of 301 department stores for the year 1921,[3] it is shown that the total expense for these stores was 27.8 per cent of the sales and the net profit was only 3.1 per cent of the total net sales for that year. In other words, the operating expenses were about nine times the amount of the net profits.

This high expense reflects somewhat the difficulty that has been encountered in 1921 in readjusting operating expenses to declining prices. Retailers have been greatly concerned as to the size of the necessary spread between the original cost of merchandise and the retail price, which spread is represented by the operating expenses. The task of reducing this by eliminating every element of waste has been conscientiously tackled by most large retailers during the past two years. Although the purpose of this paper is to indicate the line of inquiry that has been followed merely by one group[4] of stores, doubtless many similar instances could be cited by other large retailers not represented within this group.

Some examples of specific economics that have been effected are given, as these may have suggestiveness to other retailers who are studying the reduction of waste in their operating departments.

I. REDUCTION OF WASTE IN LABOR

1—Selling Departments

One of the outstanding problems in store management is the maintenance of an adequate staff of efficient personnel to give the prompt service at all times that a critical purchasing public demands. This problem is difficult because the volume of retail trade varies considerably as between different hours in the day, different days in the week and different months in the year. For example, morning hours from 9 to 11 are somewhat inactive. Although shoppers appear in increasing numbers from 11 to 3, about one-fourth of the salespeople are absent during each of these hours for lunch. Most stores do over 13 per cent of their total volume in December and only 6 per cent of their total volume in July.

To provide the staff necessary to render prompt service under these varying demands, requires daily study of the placement of the personnel force by departments and continual supervision to prevent any waste in this element of expense.

According to the Harvard Bulletin referred to, salaries and wages represent the largest single item of expense, since they approximate 56 per cent of the operating expenses of large retail stores. Personnel must be nicely balanced to prevent waste during inactive periods and to provide prompt service at the peak of the demand.

In the group of stores referred to, the first attempt to reduce personnel expense was to set new standards by obtaining comparative figures of the per capita sales output of salespeople and the production figures for non-salespeople in each of the stores, although in the latter case it was not possible to obtain this information for all positions.

A survey made in the early summer of 1921 revealed the fact that the per capita sales per selling person for the same month varied from a low point of $975 in one store, to a high point of $2,525 in another store.

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[1] Paper presented at a meeting of the Taylor Society, New York, Nov. 24, 1922.

[2] Associate Director, Retail Research Association.

[3] Made by Bureau of Business Research, Graduate School of Business Administration, Harvard University; see Bulletin No. 33.

[4] Members of the Retail Research Association, New York.

An analysis of the figures showing the productivity of salespeople by departments was made. This indicated that, although marked differences in the output of individuals in similar selling positions in different stores would continue, since they were in part caused by differences in the grade of merchandise carried or by differences in the clientele served by the various stores, nevertheless there was an adequate opportunity for reducing the direct selling cost and increasing the per capita sales per salesperson in each of the stores.

When considering various means of reducing this large item of wage expense, it was determined that a flat reduction in the wages of any group of employees was neither desirable nor necessary.

Vacancies caused by normal turnover of employees earning premium wages were, of course, filled in many cases with new employees at lower wage levels. The principal saving was effected in those stores which discovered that they were overmanned in certain selling positions, by not replacing leaving employees, and by transferring superfluous personnel to other departments. The ability to do this intelligently existed when figures showing individual production and selling costs were provided on a comparable basis. Selling tasks or quotas were also established for each department and for each individual on the basis of past experience and planned business.

In a study of the personnel in certain selling departments, it was found that the direct wage expense was unduly high in some stores, partly because men salespersons at high wage rates were used solely in these departments. Some of these men were unable to sell at a reasonable department rate. The selling force of these departments in a majority of stores represented nearly 75 per cent men. It was found by several stores in the group, however, that it was possible not only to render satisfactory service, but to reduce the direct selling cost by using women almost solely in these departments in the same selling positions, and substantial economies were effected in such stores by manipulating the selling force in such departments so that it ultimately represented only about 10 per cent men. The experience of these stores has led the way for other stores to replace men who have left, with women salespeople.

In the average retail store, a considerable portion of the time of salespeople is unoccupied in the morning between 9 and 11 because shoppers do not appear in great numbers until about noon. It has been found possible to utilize during this period some of the time of salespeople who otherwise might be idle by having them work in certain non-selling positions such as those in the Receiving and Marking Room. An economical practice that has become common is to have salespeople check and mark merchandise in a central marking room during the first two hours of the morning, since this results in the marking room being able to meet the peak demands which occur during this period because of the receipt of large shipments of merchandise. This plan has the additional advantage of using salespeople familiar with the merchandise for checking and marking it, and it has enabled the Receiving and Marking Room to operate with a much smaller force of regular employees.

Considerable reduction in the selling expense has been achieved by certain stores through the use of part-time salespersons for their peaks of business. One store whose peak occurs from 11 to 2 each day and all day Saturday, is able to reduce the idle time of its former full-time salespersons by employing a force of fifty part-time salespersons who report for work all day Saturday but who are engaged only from 11 to 2 on the other days of the week. These short-time persons employed for twenty-three hours a week replace almost the same number of full-time persons that were formerly employed. The yearly saving effected in payroll expense as result of the use of these short-time persons approximates $17,000, and those employed for the shorter period for the most part are women who are not available for full-time positions.

Maintaining a courteous and dependable force of floormen is a serious problem in every store. In large stores it is not unusual to find the expense for floormen's wages runs from $75,000 to $100,000 annually. The limitations of this position are such sometimes as to drive away the ambitious and developing men and to retain. in some cases, only those men who are complacent in an occupation with a restricted opportunity.

In an effort to reduce the waste caused by the too frequent turnover of men floor managers and to improve the service in certain departments, several stores have introduced women in this position. These women have rendered a highly efficient service, especially in intimate wear departments and children's departments. Because the weekly salary paid ranges from $30 to $60 this position has seemed much more attractive to women than to men, and as a consequence stores using women have obtained a superior type of person. In four stores alone, the women section managers represent about 50 per cent of the force. Women for this position have been recruited from the force of salespeople. As salespeople's earnings will average under $30 weekly, the use of women as section managers has opened a channel for promotion. The salaries of women in this position have averaged about 10 per cent less than the salaries paid to men.

Considerable waste has been eliminated also by better instruction of salespeople. One store found that considerable shortages in their inventory figures of piece goods were caused by salesclerks overmeasuring. Packages intercepted before delivery, when measured, showed an average overage of two inches on every sale. This loss was corrected by thorough instruction.

In some stores the practice had become rather common of sending many small articles intended for shipping, to a central wrapping desk in the shipping department for proper wrapping. By the thorough instruction of salespeople and inspectors in the selling departments, it has been possible to reduce greatly the rewrapping of such merchandise in the shipping department and to save most of the extra expense of having special wrappers for this work.

Especial progress has been made in reducing the waste caused by salespeople sending merchandise to the wrong address. One store was able to eliminate almost entirely the number of packages sent to the wrong address by the simple expedient of insisting upon salespeople printing the initials of the customer upon the address label and also by insisting upon their repeating the address to the customer.

2—Non-Selling Departments

Considerable attention has been devoted to a reduction of waste caused by the use of superfluous personnel in non-selling departments. These efforts have been particularly effective since in the average store it generally is true that more attention is given to the selling personnel, although the non-selling usually represents about 60 to 65 per cent of the entire store force.

An important item of expense in every large retail store is the delivery service. A thorough review of the personnel employed in the delivery department of each of the stores and an improvement in the methods used in routing, sorting and dispatching, made it possible to effect marked savings in the cost of the service by reducing the personnel employed.

A notable instance of this was the entire elimination of wagon boys by several of the stores and the partial elimination of wagon boys on certain routes by other stores. This was the result of changes in routes and, in some cases, changes in type of delivery vehicles. A clear saving of $2,400 yearly was effected by one store alone which reduced the number of helpers used.

Another store put a task and bonus plan in effect in the delivery department. This provided for the payment of a bonus of so much per package for all deliveries above a minimum set for each route. Although bonus payments added substantial sums to the earnings of the driver, the reduction in personnel resulted in a net saving in payroll expense in this store of $3,200 yearly.

Marked savings were also made in the delivery department in certain stores by reducing the force of packers. This was done through the use of padded returnable containers for breakable objects such as pictures, china and glassware, and the use of protective covers for trunks, baby carriages, bicycles, etc. In one large store alone, this practice resulted in the elimination of four men in the packing room who were formerly employed to especially wrap and crate such merchandise.

Another notable reduction in non-selling payroll expense was recently achieved by several stores as a result of a study of the personnel used in the cleaning department, better scheduling of the work and the adoption of more efficient standards for store cleaning. The annual payroll expense of the force necessary to keep certain large stores clean varies from $45,000 to $100,000.

A survey revealed the fact that the expense was high in certain stores because part of the work, such as window cleaning, was done by outside contractors, and the labor cost was needlessly high also in some cases because of the employment of personnel that was expensive for this sort of work. By establishing new cleaning standards, scheduling the work more efficiently, using more economical types of labor, having the work done during the day and thus avoiding the higher overtime expense that is paid for night work, and using mechanical appliances for cleaning instead of hand labor, notable economies were achieved.

The savings reported by five stores alone, as result of their job analysis of cleaning and by adopting the foregoing changes, totaled nearly $40,000.

II. REDUCTION OF WASTE IN MATERIALS

In the industrial field notable progress has been made in the last three years by the salvaging of by-products and by the standardization of containers as to sizes and weights. Large retail stores have also effected marked savings by salvaging wrapping supplies and standardizing the supplies consumed by them.

Containers used for merchandise shipped to large stores are now reclaimed and utilized over again so that very substantial savings have been effected through the reduction of the expense for purchases of new boxes, crates, excelsior and tissue. Recently, one store salvaged enough excelsior for its own needs and, in addition, sold 60 bales of surplus.

An interesting example of the use of a by-product by stores, is the utilization of waste paper for packing purposes. One store puts all its old duplicates of sales-checks and other forms through a paper shredder and uses the slit paper instead of excelsior for china packing.

The most noteworthy progress, however, is being made in the standardization of boxes used in connection with the sale of merchandise. In a survey made about a year ago, it was interesting to find that, although the merchandise sold in large stores comes only in standard sizes, the boxes purchased by the individual stores always varied in size, even when used for the same merchandise. In other words, although women's hosiery, women's gloves, men's tie, etc., were sold precisely in the same sizes in every retail store in the country, there were no less than 38 different sizes of boxes used for women's hosiery, 26 different sizes of boxes used for women's gloves, and 19 different sizes used for men's ties. Two or three standard sizes for each article mentioned will meet every need.

At the time this survey was made it was found that there were no fewer than 737 different sizes of Christmas boxes alone used in the various stores; whereas, every purpose can be served by an assortment of sizes that will total under 100, including jewelry boxes.

This survey resulted in establishing sizes for certain standard boxes for all stores and the adoption of these standard sizes has already accomplished large savings in the supply expense. For instance, it was found that the majority of stores were using a box for men's clothing that was really five inches needlessly long. In some cases, the weight of board was needlessly heavy. By adopting the standard sizes and weights recommended for suit boxes, one store saved $500 on a single order.

It was found that folding boxes would serve certain purposes for which set up boxes were formerly used. The adoption of the folding box resulted in a saving of 20 per cent in box costs.

The adoption of the standard sizes enabled one store to discontinue ten sizes of boxes formerly carried.

By standardizing their gift boxes and adopting universal sizes, another store dropped 60 sizes.

Standardization studies are now in progress with reference to weights and sizes of wrapping paper. Cases were found where stores were using paper that was needlessly heavy for wrapping merchandise, particularly when customers carried the purchases. By substituting a paper ten pounds lighter to the ream than formerly used, a saving in wrapping paper expense of $2,000 a year will be effected by one large store.

It was found to be a common practice to use a fair grade tissue paper costing from $.80 to $1.25 a ream for rough packing purposes. This purpose could be met by a tissue that could be obtained in quantities for $.40 a ream. Standards were urged upon the stores for the use of each grade of paper so as to reduce this item of expense. Further economy is obtained by using for many purposes a smaller sheet instead of the 20 x 30 size which has been the traditional stock size.

A large item of wrapping expense is the heavier twines. The price of this has so risen at times as to make its use for certain purposes almost prohibitive. Twines have been standardized and stores now use only four or even three where formerly from five to ten different kinds were used. Cotton twines have replaced expensive heavier twines for certain purposes. Stores also have been urged to use gummed tape as a substitute for twine, since tape will serve many purposes with some savings in expense.

Standardization studies have also been undertaken covering the size and grade of merchandise bags and envelopes which are used so largely for "taken" purchases. This is now under way and it will result in considerable savings by having smaller-sized envelopes used in many cases as a substitute for larger and more expensive sizes.

The method of marking merchandise and the type of labels and tickets used have been studied and are gradually being standardized.

Standards have been set as to the best use of certain labels, marking tags and pin tickets for the marking of merchandise, which will result in a unit cost of marking lower than any standard of the past.

Labor saving appliances for making and attaching the marking devices are gradually becoming standardized in all stores.

In addition to the economy resulting from the standardization of materials, many extra savings have been made by more intelligent use of the materials that have been standardized. It had been a practice, for instance, in certain stores to wrap entirely certain large articles like rugs to be delivered locally. This has been discontinued by certain stores, although, in some cases, the ends of the rugs are still wrapped. Elaborate protective wrappings on house furnishing articles, victrola records, etc., have been omitted, as these goods can be delivered locally in good condition without wrapping when the drivers use ordinary care in handling.

One store alone by a careful supervision of the use made of wrapping supplies reduced its supply expense from a cost of 1.3c per transaction to ¾c a transaction.

III. REDUCTION OF WASTE IN EQUIPMENT

Much study has been devoted to the better use of labor saving equipment and the better utilization of mechanical appliances so as to save hand labor.

In the delivery department of one store, better planning and scheduling of the delivery equipment permitted more economical loading of trucks, which resulted in the removal of four wagons from certain routes during nine months in the year with a saving of $5,000 a year.

In another store, by a re-arrangement of the physical layout of the shipping department and a change in the sorting table to permit more advantageous handling of packages, it was possible to reduce the personnel and save $4,300 in salaries.

In a survey as to the locations where cash registers could best be placed, a number of departments in certain stores were found equipped with registers where they were neither desirable nor necessary. Recommendations were made as to the best placement of all machines so as to save the cost of needless additional equipment. The importance of proper placement of registers will be realized when it is stated that a certain register commonly used in large retail stores costs about $800 each, and that many large stores will have in use from 50 to 100 such registers.

The laundry expense of four large stores has been reduced by the purchase of laundry machines and by doing the laundry work in the stores. One store estimates that the saving effected by doing the work itself as compared with the lowest contract it could effect with an outside laundry, is $13,000 yearly. Another store accomplished a clear saving of $708 within the first three months of operating its own laundry, and expects to save $6,000 annually after the first year.

The layout of a number of departments has been changed to speed the flow of work. Portable tables have been installed in the marking rooms of most of the stores to save the expense of needless rehandling of goods after checking and marking. Such tables permit conveying goods to reserve stock rooms without rehandling.

A special truck is in use in several of the stores to save rehandling and breakage of china when it is conveyed from the selling department to the packing room. One type of truck has reduced the breakage to 5 per cent of the former amount and it does the work of two men.

Many extra savings have been achieved by the adoption of labor saving devices to replace hand labor. Special reports have been furnished to each store on most of the devices which can be commonly used.

The savings represented merely by the instances given in this paper of the efforts made by one group of stores to reduce waste in their various departments aggregate over $100,000. The figures quoted represent merely those savings that have actually been reported by certain stores as having resulted from their research studies. Naturally, these represent only a part of the savings that have rewarded the efforts of large stores throughout the country to reduce or eliminate waste in their operating departments.

In conclusion it should be emphasized that studies of the sort mentioned in this paper indicate that representative department stores throughout the country have followed the lead of industry and are showing a widespread interest in practical research work. At present, stores are more interested than ever in analyzing their established practices and methods; checking these up carefully with practices and methods found in other stores; weighing all facts impartially in the true spirit of research; and then changing their practices and substituting those which offer the most promise for more economical operation and distribution.

DISCUSSION

The Consulting Engineer's Point of View

IT IS generally agreed upon by the department store managers themselves that the retail store costs of distribution are too great, but the conception that it is possible to reduce this cost by research is quite a new one, and so far as I know, the Retail Research Association was the first organization to attack the problem in a systematic manner. There are a number of sources of information available to the department store man which enable him to determine the general average of expenses, but as is always the case with some managers, there seems to be a general tendency to use these figures to prove that the organization is as good as the average. It is comparatively simple for any well-organized concern to equal or better these average figures since an average always includes low as well as high figures.

After reading and listening with a great deal of interest to this tantalizing paper and comparing the experiences contained therein with my own in the department store field, I feel tempted to ask: Is Mr. Reilly giving a complete story of results?

He calls our attention to the fact that 56 per cent of the expenses of the department store are in salaries and wages, and many large department stores number their employees by the thousands. Every management engineer knows that in most lines of work, savings in personnel costs by scientific research, standardization and control, of from 10 to 50 per cent are quite within the range of possibilities, yet he doesn't even give us old timers the satisfaction of saying, "I told you so! I knew it would work in department stores as well!"

I do not presume that the Retail Research Association makes any pretense of developing scientific management in the stores of its members, but I believe it necessary, since this paper has been delivered before the Taylor Society and will be printed in its BULLETIN, to utter a word of caution lest someone should misunderstand. Such things as the following cannot be dignified by the term of scientific management, and I do not believe Mr. Reilly intended to give that impression.

1. Hiring new people at lower wages. Scientific Management stands for high wages and low production costs.

2. Changing from men to women workers to reduce wage expense. Scientific management requires that the worker shall be scientifically fitted to the job. In some cases it has been shown that women were better fitted for the work than men, but one gets the impression that the dominating motive is to get cheaper help.

3. Happy ideas, machinery and other labor-saving devices are not necessarily scientific and as a matter of fact usually are not. They exist in many of the most poorly-managed companies. It is the manner of devising the method that determines whether or not it is scientific.

Mr. Reilly says that on the various things mentioned, four stores reported savings of $100,000; that is, $25,000 each. One single store that I am familiar with by the application of the scientific methods made a saving of several times Mr. Reilly's aggregate and I know that they did not complete the job.

Knowing department store managers as I do, I have a sympathetic knowledge of the difficulties that Mr. Reilly's workers must have encountered; but also knowing Mr. Reilly's work as I do, I cannot help but feel that he is not giving a complete story of results.

It would have been interesting and helpful had the author of the paper given us a description of his methods of investigation; for instance, his methods of measurement of the output of non-selling workers. If any department store manager will make such measurements in the proper way, he will discover possibilities of saving much larger than shown in this paper.

Neither has he told us anything about his control methods, though I have no doubt he could give us some interesting material there. My experience is that most department stores have little conception of what scientific control can do for them. They usually have highly specialized accounting and expense reports, but how many have output reports based upon scientific standards or standard units?

On standardization he is more profuse in his illustrations; they look good, but for some reason the savings are not as great as I should have expected. Also, he has spoken only of standardization as applied to materials. It is possible to make great savings by applying the same principles to policies, methods, equipment, tools, and so on.

I wish to emphasize the difference between the exchange of statistics and information concerning methods which have "grown up," and real scientific experiment to determine the one best way. In my paper before this Society printed in Vol. 7, No. 1 of the BULLETIN of the Society, I said, "Scientific management may be briefly described as the application of the highest degree of coordination and control on the basis of scientifically determined standards of policies, materials, equipment, tools and methods." Scientific management therefore does not consist of copying the methods—even the best methods—of other institutions. The exchange of ideas is a very wholesome practice and department stores are exceedingly mindful of this fact. I know of no other institutions that are so liberal in the giving of information, or willingness to take advantage of it. But while this is a step in advance of the old practice of secrecy, it cannot and should not replace experimental research work. In the paper mentioned I described, for instance, a very complete test of bookkeeping machines. Previous to making this test the company concerned had studied a report issued by an organization of department stores, which listed the machines which were most frequently used, and in addition had sent one of their representatives on an extended tour of the country to inspect machines in use. As a result of the tour the company decided upon one make of machine; but our test, which extended over a period of six weeks, showed that this machine was the third best, and that by purchasing the machine with the best record, which had previously not even been considered as a "dark horse," there was a possible saving of $20,000 the first year.

Another example that might be cited. An analysis of the trucking of merchandise from the elevators to the delivery room showed that because of the layout it was necessary to truck a large percentage of merchandise 900 feet each trip. Scientific analysis enabled us to cut this to 100 feet.

The opening of mail was performed by sales clerks who were unemployed in the morning. There were twenty of these workers and the work was very inefficiently done. By standardizing the task and employing workers permanently, utilizing their time the balance of the day on other work, the mail was much more satisfactorily opened with two people.

In another case it was necessary to move the Accounts Payable Department from one location to another. In studying the possibility of making this move it was discovered that the room assigned was not large enough to accommodate the desks. An abnormally large desk was used and we found by analysis that the reason for this was large books of account. Further analysis of the unit of space, the ledger sheet, showed that the book could be reduced 60 per cent in size by reducing the page 60 per cent in size. The smaller books made smaller desks possible, and this again made it possible to get the desks into the new room assigned.

Scientific research on the question of complaints showed that these could be reduced to an astonishingly low number by analyzing the causes of these complaints and applying the remedy. In one case over 1000 complaints a month were entirely eliminated by this sort of detail analysis. This meant not only the elimination of the cost of handling the complaints, but the elimination of the loss of good will.

By analysis of the records of workers throughout the entire establishment, it was learned that many errors could be eliminated by better training.

Mr. Reilly mentions a study of routes to determine whether or not packages were economicaly delivered. There are very diverse possibilities for performance along this line. Exchange of information will give little more than the facts that some people deliver packages for $.15, and others for as high as $.40, whereas scientific analysis of the problem will uncover the following conditions:

1. Most routes have not been determined by a careful study of the territory and therefore involve much useless traveling.

2. Wagons leave with only a partial load when a better distribution would give all a full load.

3. Merchandise is not properly dispatched, and some drivers lose two or three hours of their working time every day waiting at the store.

A scientific analysis of the packing methods of almost any department store will show the possibility of eliminating 25 to 30 per cent of the expense.

As Mr. Reilly has shown us, department stores are full of waste and the cost of retail distribution can be very greatly reduced. While improvement through the exchange of information is a good beginning, it behooves progressive stores to establish at once a real scientific research department, not as an exchange bureau, but one which will by analysis and experiment investigate each problem in terms of its particular conditions. It is practically impossible to exchange information on delivery problems in different cities with any hope of accomplishing satisfactory results. Conditions in each town are different from those in other towns.

Scientific management requires a new viewpoint. Those department stores that are satisfied to be as good as the average cannot appreciate this viewpoint, but any who have made an effort to determine the possibilities of scientific research will not rest satisfied until they have determined the one best method under particular circumstances, for the one best method will so far exceed the average method as to leave the average store far in the background.

Dr. Person in his admirable paper last night predicted an era of intense competition. This intense competition is at present being felt by the department stores and the effort to improve it is largely in the hands of the merchandise managers. A very large percentage of the expense, however, is on items which are ordinarily not under the control of the merchandise manager, and these items offer a great virgin field for research. The Retail Research Association has made a good beginning, but let us hope it is not the end. The first stage in the betterment of industrial methods is comparative study of existing methods; but the final stage is that scientific experimentation which discovers the best possible methods.

COMMUNICATIONS

At the Fall meeting of the Society a year ago I called attention[1] to the fact that the principal development of scientific management took place during a period of continuously rising prices—from the late eighties until the peak in 1920—and that the methods and even the principles which were found so satisfactory under easy business conditions must be thoroughly scrutinized if the future of scientific management is to be as significant as its past.

I was therefore particularly pleased to listen to Mr. Person's paper on "Shaping Your Management to Meet Developing Industrial Conditions,"[2] at the recent New York meeting. In that paper he dealt in a capable and foresighted manner with the managerial problems ahead of us. He showed that to meet those problems the significance of scientific management must be realized fully—in selling and finance as well as in production, and from the point of view of a business as a whole as well as from the departmental point of view. If the proponents of scientific management appreciate the real nature, so ably pointed out in Dr. Person's paper, of the management problem during the next ten years, and if they appreciate the applicability of their principles to every phase of the management problem as presented in that paper, then the future achievements of scientific management will be even greater than those of the past.

HENRY H. FARQUHAR.

THE paper by Dr. Person, at the recent meeting of the Society,[2] has raised a number of important questions about managerial policy which will bear a considerable amount of discussion. One question in particular warrants attention, namely, the question of sales policy.

It is the ambition of every enterprise to grow and to expand into a large business, which means concretely, to enlarge its sales. But it is just in the manner in which that enlargement of sales is carried out that the difficulty lies. For obviously in times of expansion when everything is booming and prices are rising, the expansion of sales occurs. And after a period of growing sales there inevitably comes a period of declining sales.

Now the reason for that change apparently is this: when prices are rising buyers are increasing their purchases, egged on in no small measure by salesmen who predict even higher prices. Purchasers therefore "buy for the rise" and continue to buy more, the more prices rise. Inventories or stores grow and then suddenly prices begin to fall. Then it is discovered that everyone has overbought and the sales of a company, which have soared, drop practically to nothing. Manifestly, a buyer who has stacked up beyond his needs will, when depression comes, be out of the market until his overstocks have been reduced.

Thus it so frequently happens that a company or an industry which has had extraordinary increases in sales during prosperity must practically close down for months afterwards because its sales have practically disappeared.

From the point of view of management the conception of sales needs further scrutiny. When one producer sells to another, or to a distributor, *from the point of view of management* the goods "sold" have merely passed from one stage to another stage in the process of production and distribution. They haven't been sold until they have passed into the hands of the final consumer or user. They are still goods in process. And if through sales acceleration and rising prices, one stage overbuys and builds up its stores, it is just as detrimental as if the machine shop, let us say, loaded up on castings; when the shop stops its loading up, the foundry must shut down until the large store of castings has been used up.

If the aim of management is to stabilize and regularize production, then overselling is just as bad as the underselling which it produces, as cause and effect. A few organizations have realized this and have formulated a sales policy accordingly. The long term view of sales means that the sales of one organization cannot exceed the sales of the organizations to which it sells. When for short periods the sale of, say cloth, exceeds the sale of the garments made from that cloth, then it is obvious that, sooner or later, the sales of cloth must fall off until the excess purchases of cloth are used up.

There are good grounds for believing that the feverish activity in production and sales of 1919 and the early months of 1920 was due to such overselling or overbuying, from the consequences of which we are just escaping.

We may face a period of falling prices or rising prices considered from the long term view. But in either case we shall undoubtedly have short periods of expansion and contraction, of prosperity and depression.

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[1] Bulletin of the Taylor Society, Vol. VI, No. 6.

[2] "Shaping Your Management to Meet Developing Industrial Conditions"; Vol. VII, p. 211.

In general a period of depression and curtailed industrial activity will last as long as it is necessary to use up the accumulated stocks due to overbuying in the period of prosperity. A sales policy which fosters overbuying must pay the penalty of reduced sales later, for in the long run the sales of one organization cannot exceed the sales of the organizations to which it sells its product.

The raw materials and equipment of one enterprise are but finished products of other enterprises, just as the materials-in-process of one department of a single enterprise are the finished products of other departments of that enterprise. The series of processes between the first step of securing crude material from nature and the final step of delivering a commodity to consumers is one great enterprise of which specialized manufacturing and distributing are departments. The principle of balanced inventories applies to the whole as well as to the parts, and should be basic in sales policy.

L. K. Frank.

REVIEWS

Factory Storekeeping: the Control and Storage of Materials. By Henry H. Farquhar. McGraw-Hill Book Co., New York, 1922, pp. xi, 182.

The special importance that has attached to inventories during the past two years makes Mr. Farquhar's book of special timeliness. In a good many cases the amount of the loss that had to be taken in writing down the inventories of industrial plants was only partly due to the shrinkage in market values that was beyond individual control; many industrial plants paid an additional penalty for not having kept the quantity of inventory under strict control, and for allowing speculative purchasing to take the place of purchasing for reasonable manufacturing requirements. Perhaps the lesson that the recent depression has taught us will cause Mr. Farquhar's book to be more widely read and carefully studied than might be the case in more heedless times.

It is a small book, but it contains a succinct analysis of the problem of stores control, and outlines principles and methods well worth observing. It is in no sense dogmatic as to method, but the sound principles discussed in it are good dogma, as sound principles must ever be.

The materials of production are the food of industry. Without an adequate and steady supply of them, it is ill nourished; with them it can live sanely on a well-balanced diet or gorge itself to repletion, using them wastefully or well, according to its housekeeping ability.

Materials are valuable and should be well cared for; an excessive supply ties up capital unnecessarily and increases the risk of loss due to depreciation of both market value and quality; an inadequate supply disorganizes the work of production and increases its cost; waste of material is just plain waste, like war, and plague, and graft; failure to guard and account for valuable material means inefficiency, temptation to thievery and carelessness, and, perhaps worst of all, ignorance of costs, which is a cardinal sin against customer, competitor, and self. These are major phases of the problem of factory storekeeping, and consideration of them should guide the reader of Mr. Farquhar's book in his study of the methods, both general and specific, suggested for dealing with them.

Precision in the control of processes and of funds, for instance, is generally admitted to be desirable. Why not precision in the control of material? Knowledge as nearly exact as possible for what we need in the way of material, when we heed it, where and how it should be stored, how long it takes to get it, what it is going to cost or has cost, how much in units and value we already have, whether we are getting the quality we pay for, whether we have too much or too little capital tied up in inventory, whether our stocks are being handled expeditiously or at minimum cost—real knowledge concerning these and similar points is essential to effective factory management.

The methods of obtaining and using this knowledge, as pointed out by Mr. Farquhar, are sensible and well founded in practice. A great many plants have enclosed stores departments and some sort of stock record or stock balance sheets, but there is still a surprisingly large number in which a physical inventory must be relied upon to tell what is the count and value of material on hand. Surprisingly few also are the cases in which the stock records form an integral part of a cost and accounting scheme which provides current and even reasonably accurate information about inventories and material costs in production. Even when such a fortunate co-ordination of records exists, adequate connection with the production planning and purchasing is frequently missing. Good storeskeeping is a function with many points of contact in an industrial organization, and Mr. Farquahr has very ably shown its comprehensive nature. It is worthy of more than casual attention, and it is to be hoped that Mr. Farquhar's exposition of the subject will be widely read and carefully studied.

It is to be regretted that what is perhaps the most important illustration in the book (Fig. 5, p. 61, Four-column balance of stores sheet) had to be so reduced in scale for printing as to be difficult to read. In the main, however, the book is well got up and readable, with logical and useful chapter divisions. It is indeed gratifying to find a book on factory storeskeeping that recognizes the importance of classification and symbolization of materials and continuous material accounting as integral parts of the general accounting scheme for business. Mr. Farquhar might very well have given them even more extended treatment.

Only with respect to details or certain specific suggested methods can one find reason to differ with the author. He refers somewhere to the operating importance of occasional "tremendous trifles," and this serves to bring to mind one which is not mentioned in the book. That is the importance of having specific price information on the purchase order, so that there shall be no delay in entering values on balance of stores sheets and notices of receipt or issue of material. Primary dependence on the invoice for this information always leaves in suspense an appreciable number of transactions, and hampers the work of the material planning, cost, and accounting departments. Negligence or laziness in the purchasing department is often the only obstacle to be overcome in this matter. Insistence on having prices and terms detailed on the purchase order will speed up the material accounting and make it more useful because then more nearly current. Perhaps other "trifles" will be found worthy of discussion and debate among those interested in factory storeskeeping. No better fate could await Mr. Farquhar's book, which we trust will attain wide circulation.

J. D. Walsh, Jr.[1]

Trade Association Activities and the Law. By Franklin D. Jones. McGraw-Hill Book Company, New York, 1922, pp. xii, 360.

This book, according to the author, "has a twofold purpose; first, an endeavor is made to explain . . . the meaning and purpose of the laws regulating competition; second, a summary is presented of that great group of lawful activities in which our trade associations are steadily achieving results of vast benefit to industry and to the nation."

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[1] Sanderson & Porter, New York.